

The

Ecologist

Journal of the Post Industrial Age

Vol.6. No.2.

February 1976 40p

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Disease and the Ecological Perspective ■ The Politics of Soil Conservation



Traditional Cooling Systems

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Editor: Edward Goldsmith. Assistant Editor: Ruth Lumley-Smith.

Associate Editors: Robert Allen, Michael Allaby, Peter Bunyard, Brian Johnson, Jimoh Omo Fadaka,
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Advertisement Manager: Philip Hutchings

Advertisement enquiries to: Uphill, Urchfont, Devizes, Wilts. Tel: Chirton (038 084) 370.

Published by Ecosystems Ltd., Registered Office: 73 Molesworth Street, Wadebridge, Cornwall PL27 7DS, England.

Distributed by: A.M.D. Ltd., Roding Trading Estate, London Road, Barking, Essex IG11 88U.

Printed by Penwell Limited, Parkwood, Callington, Cornwall. Tel: St. Dominick (05795) 522.



Value Judgements - Can They be Scientific

At a recent workshop at the Institute of Terrestrial Ecology* on 'Ecology and Planning', Dr. M. W. Holdgate, formerly Chief Scientist at The Department of the Environment made a statement which he should not be allowed to get away with. He said: 'Planners commonly confused ecology as a basic science, concerned to describe and explain patterns of distribution of species and communities in space and time, with the particular application of ecology to wild life conservation, which defined areas of outstanding conservation interest and made value judgements about land use priorities. Surveys undertaken by ecologists could likewise be at two levels — basic, scientific descriptions of environmental patterns or evaluations in terms of indices of species diversity, rarity and the like. It was suggested that both kinds of survey have had their uses, but that the former is an essential data base for land use planning while the latter is useful to set alongside other evaluations like those of agricultural, silvicultural and amenity value.'

What is wrong with this? — and modern science in general? First of all a mere 'description of patterns of distribution of species and communities of space and time' is not ecology, nor science for that matter as Dr. Holdgate himself seems to imply. An explanation is also necessary. What, however, do we mean by explanation? In this case it must mean showing why species and communities are distributed in the way they are; what caused them to be distributed in this way, what is achieved by this type of distribution, what is, in fact, the goal or purpose of such a distribution.

Now, as has been pointed out many times in this journal, to provide a description, it suffices to accumulate data. The scientific method, as it is understood today, *provides a method for doing this*. To provide an explanation, however, requires much more than the accumulation of data. The most elaborate data, even in the form of the most precise statistics explain nothing. To do so, they must be *interpreted*. In other words data must be *organised* into *information* which provides a model, implicitly or explicitly, of the situation one wishes to explain. It is only on the basis of such a model that any rational land use policy, or any other policy for that matter, can be based.

Now, and this is particularly important, *scientific method does not provide any method whatsoever for interpreting data*. Any data can be interpreted in an infinite number of ways in accordance with the

implicit subjective model, or world-view which different people have built up. The interpretation which Dr. Holdgate would presumably regard as 'scientific' is simply *that which is consistent with the world-view of our industrial society which unfortunately underlies that of most of the scientists working within it*.

Thus, Dr. Holdgate would presumably regard as 'scientific' a land use policy accommodating present pressures towards increasing urbanisation (more motorways, more reservoirs, more airports etc.), though he would probably concede that certain nature reserves are desirable to preserve rare species and forms of life of 'particular scientific interest', for such a policy does not affect the industrialisation process to which Dr. Holdgate appears committed emotionally and intellectually. On the other hand, a land use policy which does *not* accommodate these trends he would regard as a 'value judgement'!

What however, is a value judgement? Presumably, it is a statement of how things *ought* to be rather than of how they appear to be on the basis of accumulated data. If this is so, then both policies are *value judgements* for both are based on an implicit notion of how things *ought* to be. What is more, Dr. Holdgate's notion is no more 'scientific' than is ours. In fact if the term 'scientific' were used correctly, it is a good deal less so.

I shall explain why — but first, what is the use of accumulating data in the first place? Or of building up knowledge of any kind? The answer is clearly so as to serve as a guide to adaptive behaviour; more precisely, to enable a person (or any other natural system for that matter) to build up a model which, in a behavioural context, is not simply of the environment, but of his or its relationship with the environment. As the new discipline of cybernetics has revealed, such a model is essential to all control mechanisms. It is on the basis of such a model that responses are mediated and monitored. Now this would be impossible unless it was quite clear in the first place *what the relationship between the system and its environment ought to be*. It is only then that *divergencies from the optimum relationship can be noted and corrected*. This is what monitoring means.

When a guided missile makes its way towards its target, diversions from the course it must take, in order to hit it, are corrected in this way. When a doctor takes someone's temperature and measures his blood pressure, the results are only of value

because he knows what his temperature and blood pressure ought to be.

If a social scientist, with any knowledge of societies, looks at the levels of delinquency, vandalism, drug addiction, and alcoholism in a society, this information would be of value, *only if he knew* what the levels ought to be if the society is to be a healthy one. Similarly consulting such ecological 'indices' as 'species diversity, rarity and the like' are of value to the ecologist only if he knows *what their level ought to be*. But 'ought to be' for what purpose one might ask? One understands what the purpose of the guided missile is:- to hit its target. One also understands what the doctor's goal is:- to keep the human body healthy, though this term has not been very clearly defined. But what is the goal of an ecosystem? This is undoubtedly the first question that ecologists must answer, otherwise they cannot provide any real ecological explanations and their work must remain purely descriptive. In fact, if the role of ecologists and scientists of all sorts is to be more than to accumulate useless data, and if these data can conceivably serve as a basis for adaptive behaviour (which they very rarely do today), then we must know what is the purpose of an ecosystem, indeed of that overall ecosystem which is the biosphere. Only then can we say what the data we accumulate ought to be like — or more precisely what ought to be the values of the variables we take into account — not so that they might accommodate the aberrant behaviour of industrial man, but the adaptive evolutionary processes which can alone assure the stability of the biosphere and its component sub-systems.

What is this goal? The answer, which we have never

ceased to point out in this journal, is *stability*, which is best regarded as that course along which systems must move if they are to preserve their basic structure in the face of change, or, seen slightly differently, if discontinuities of all sorts are to be reduced to a minimum — if in fact they are to survive.

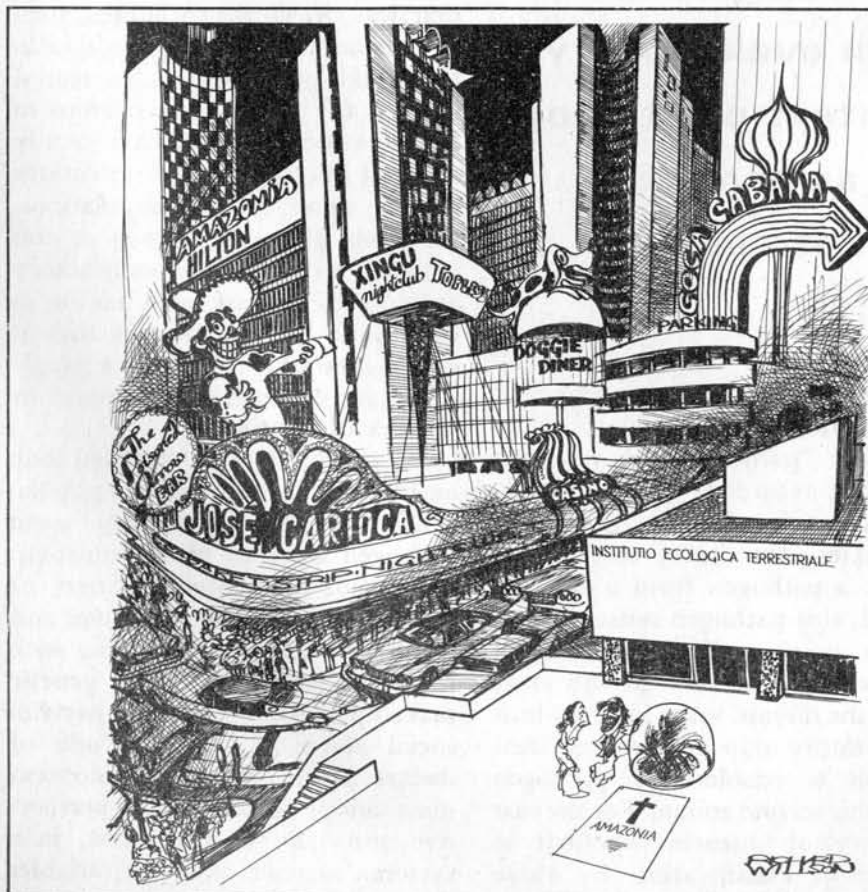
On this basis, it is easy to explain why species diversity must be maintained, why it is unwise to cut down the world's tropical forests, or pave over what still remains unpaved in this country. All these activities, for reasons which Dr. Holdgate should know, *must reduce the stability of ecosystems and hence the biosphere as a whole*.

On this basis, it can also be shown that the values underlying the world-view of industrial man, in terms of which he justifies the systematic destruction of his natural environment, are ecologically and indeed scientifically unsound, and why those that underlie the world-view of primitive hunter/gatherer societies, on the basis of which they preserved their natural environment, are ecologically, indeed scientifically valid.

Value judgements, contrary to what many of today's scientists believe, fall very much within the scope of ecology and science. If behaviour patterns can be judged scientifically so can the principles underlying the model on the basis of which they are mediated, so long of course, as we have first determined what ought to be the goal of behaviour within the biosphere.

Edward Goldsmith

* Ecology and Planning: Report of a Workshop, by M. W. Holdgate and M. J. Woodman, in 'Bulletin', British Ecological Society, Vol. 4, December, 1975.



"Sad? That's a pure value judgement! There was absolutely no scientific reason for preserving it!"

DISEASE AND THE PERSPECTIVE

by Kenneth H. Jacobs

The importance of disease in human evolution was discussed by Haldane more than a quarter of a century ago (24). Since then, increasing attention has been given to the influence of disease upon the adaptation of human populations to their environment (1-3, 5, 33, 35, 38, 44), but little progress has been made, because of an inadequate understanding of what disease is, and how it arises.

In the present paper, we give an account of the widely prevalent germ theory of disease and oppose to it an explicitly ecological approach which lends itself more readily to studies of the role of disease in evolution. Within the framework of the ecological approach, we propose a model of the interaction of disease with a population and indicate its applications in many problems relating to the health of human populations.

The Development of the Germ Theory

Throughout history, the dominant view of disease has been that it is a "dis-eased" condition of the individual, arising when his body is invaded by some specific entity (16). This approach* can be seen, in a very real sense, as a development of the widespread belief in possession by demons (42, 53). A demon, upon entering the individual's body, induced a clearly pathological condition; to eliminate the condition, it was necessary to exorcise the demon.

In the scientific account, the place of the demon was taken by microbes. During the 17th and 18th centuries, an increasingly sophisticated classification of these "disease entities" was developed (17). Such an approach was encouraged by

* Sometimes called the ontological approach (53) but more simply regarded as a clarification by types or typological analysis.

Linnaeus' successes in classifying plant and animal species, and by the contemporary emphasis upon description, definition, and classification (21); as embodied in the works of Sydenham (1624-1689), Ozanam (1773-1837), and Bretonneau (1778-1842), it was to be extraordinarily influential in shaping the theories of subsequent workers. In the 19th century, Pasteur, Koch, and others achieved great successes within this tradition in their work on acute microbial diseases and formulated the central doctrine of the typological approach, that of "specific aetiology" (19,20).

The study of disease in an evolutionary context must adopt an ecological perspective

This doctrine asserts that to each disease there corresponds a single germ, or "pathogen." If a disease is to be regarded as "classified", it must satisfy all of Koch's famous postulates. One must be able to isolate a pathogen from a diseased animal; this pathogen must then be grown on a culture medium; a sample from this new growth must cause the disease when injected into a laboratory animal; one must then be able to reisolate the pathogen from this second animal. For the vast majority of diseases prevalent at the time, classification by these criteria was indeed possible. More-

over, the identification of pathogenic agents associated with several of the serious illnesses of the time meant that more appropriate measures could be taken for the treatment and prevention of these diseases. Public health and immunization programmes were initiated, and minimum standards of public sanitation were imposed, often against considerable public opposition (47). Many diseases were eliminated as major epidemic threats. There arose the hope — which to some extent still persists — that by the application of health measures based upon the germ theory all diseases might be entirely eradicated (15, 19, 27).

Unquestionably, the germ theory has been of great value to clinical medicine. It is the foundation of all modern medical and public health practices. Medical procedures, such as antibiotic therapy and vaccination, and public health measures, such as the draining of swamps in malaria-control efforts, have greatly reduced the burden of infectious disease upon human populations. However, the germ theory is too narrow to allow a satisfactory account of disease as a factor in evolution: its weakness is that it emphasises the role of a single dominant variable, the presence or absence of a pathogen.

It is increasingly recognised that an individual's (and hence a population's) susceptibility to any given pathogen is by no means constant; it depends upon a wide variety of factors, both in the individual and in his environment, including such things as nutrition (48), genetic make-up (40, 41), and psychosocial status (39). Any study of disease in an evolutionary context must adopt an ecological perspective and take into account, in a systemic manner, *all* of the variables involved in the disease process.

ECOLOGICAL

Alan H. Goodman, and George J. Armelagos.

The Development of an Ecological Approach

The ecological approach to disease can be traced back to doctrines attributed to Hippocrates (19). For Hippocrates, health was the expression of a harmonious balance between the components of human nature (that is, the four humours) and the environment and way of life of the individual. Disease resulted from the disruption of this balance, through the deficiency or excess of one or more factors (20). These doctrines were taken up and elaborated by a number of mediaeval writers, notably Galen (born: AD 131). However, following the work of Renaissance scientists such as Harvey (1578-1657) and Vesalius (1514-1564), there was an almost total rejection of Galenic learning, and the Hippocratic tradition passed into eclipse.

Nevertheless, the ideas of the harmful influences of bad air and bad water which are found in Hippocrates' "On Air, Water, and Places" persisted even in the midst of the germ theory revolution of Pasteur and Koch. "Swamp fever," for example, was believed to be a consequence of extended exposure to swamp air; it was eventually renamed "malaria" from the Italian word for "foul air."

Recently the basic Hippocratic concepts of environmental balance have been revived. In 1960, May (34) proposed a model consisting of a dynamic system of three variables: host, pathogen, and environment. To make the model more specific for human populations, he introduced culture as an additional factor affecting disease distribution and intensity. Many workers have adopted this model and used it in reconstructing the disease-structure of human populations at various stages of cultural evolution (4-6, 15,

44).

May's model retains some of the limitations of the simple germ theory, since it still assumes the existence of a pathogen that satisfies Koch's postulates. It is adequate for the analysis of infectious diseases, but cannot accommodate those diseases for which it is not possible to isolate or culture a pathogen. It cannot be applied, for example, to atherosclerosis, or to schizophrenia.

In the light of this difficulty, Audy (7) has suggested that the



idea of a pathogen should be replaced by the broader concept of an "insult", which may be "chemical, physical, infectious, psychological, or social" [(7), p. 142;] thus, he acknowledges the possibility that a wide variety of stimuli may give rise to disease. This is a very promising approach and suggests ways of achieving a more detailed analysis of the host-insult-environment system. As presented, however, it raises more questions than it answers. In what ways do they differ? How are these similarities and differences reflected in the individual's response? What can we infer about the adaptation and evolution of individuals and population? To these questions we now turn our attention.

In what follows, we present a model of the host-insult-environment system which seems to give an orderly account of the many variables involved. The model is developed in three parts: a discussion of the human environment; of the nature of stimulus reception by the human organism; and of the response of the organism to these stimuli.

The Environment

We have tried to construct a model of the environment that is convenient for ecological and evolutionary analysis. In the model that we have chosen, the environment is divided into three components: the inorganic, the organic, and the super-organic (culture). This distinction, found in both the ecological (25, 52) and the evolutionary (26,18) literature, emphasises features which are essential to the holistic understanding of the nature of disease (10,34).

The inorganic component of the environment includes stimuli such as temperature, humidity, oxygen pressure, ultraviolet and cosmic radiation, and trace elements in the soil and water. The disorders arising from excess or deficiency of such stimuli are well known. Too much ultraviolet radiation, for example, is associated with diseases of the skin, ranging in seriousness from skin cancer down to the destruction of the dermal layer, which may be accompanied by swelling, inflammation, and severe secondary infections. Too little ultra-violet radiation will lead, in the absence of adequate dietary sources of vitamin D, to rickets in children, and to osteomalacia, a bone condition, in adults (9,32). The situation is similar for all inorganic stimuli: the individual is adapted to function most efficiently when the stimulus lies within a certain optimum range,

and deviations of the stimulus outside that range, in whatever direction, will invariably lead to a deterioration in the individual's condition.

The organic component of the environment provides a large proportion of the stimuli we receive, and serves as the source of our food. It includes a wide range of predators for which we ourselves provide energy; these predators are not the large carnivores, but microscopic organisms, protozoan, metazoan, bacterial, rickettsial, and viral. As has long been recognised, such organisms are responsible for a majority of human ailments; we give one example for each of the above kinds of organism; malaria, schistosomiasis, tuberculosis, scrub typhus and influenza.

The superorganic component is a distinctively human phenomenon, and corresponds roughly to the anthropological concept of culture (28,56); it consists of our technological, social, and ideological systems. It functions within the total environmental framework in two ways: by modifying the frequency and intensity of exposure to inorganic and organic stimuli; and by creating a set of informational stimuli that are uniquely its own (6).

The role of the culture in modifying the interaction between the inorganic environment and the population may be seen in the use of clothing, or the addition of vitamin D to dairy products, both practices which will alter the significance of ultra-violet radiation for the population. Likewise, a population's relationship with the organic environment will be changed when a tropical rainforest is cleared and slash-and-burn agriculture is introduced. In this case, an environment conducive to the development of endemic malaria will have been created (31).

Another aspect of the cultural environment is the use of medical practices to influence the distribution and prevalence of a disease. Diseases of which the causes are known (that is, infectious diseases for which a pathogen has been isolated) are the most susceptible to control in this way, but even here failure is possible if other super-

organic factors are exerting an influence in an opposite direction. In the case of syphilis, for example, although a great deal is known about the pathogen, its life cycle, and effective antibiotic treatments, it has not been possible to eradicate the disease, largely because its spread and persistence are favoured by the prevailing patterns of social and sexual behaviour (46).

We consider finally the stimuli which are unique to the culture. The culture of a social unit is expressed in symbolic communications between its members; these symbolic communications constitute a set of stimuli in the form of information. Continual change and uncertainty in the relationship of the individual to his social and ideological systems will be reflected in a constantly changing information input, and may result in psychological and social stress (39). Superorganic factors play a part in the origin of schizophrenia. It is thought that the disorder tends to appear when the individual is placed in what is called a "double bind" situation, in which the simultaneous presentation of two contradictory messages leaves no correct response open (8,50).

The Organism

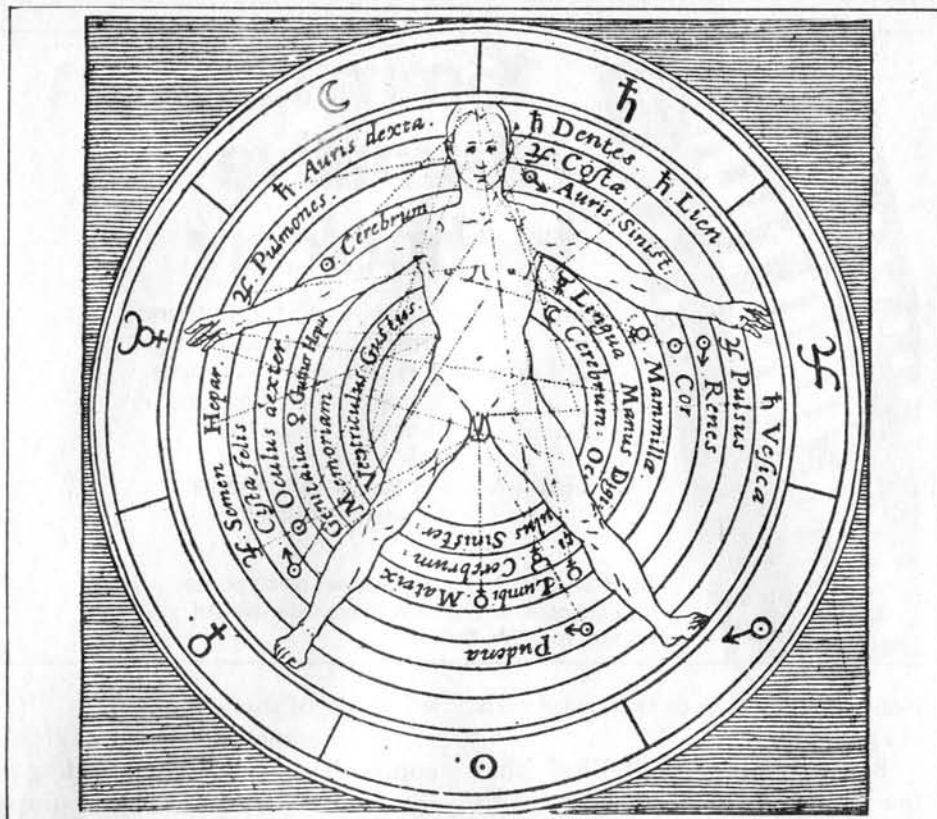
We must now direct our attention to the ways in which the environmental stimuli are received by the organism. Previous ecological models have tended to concentrate on the complexity of the environment, while assuming that the organism will always react to given stimuli in an anticipated manner (the "black box" approach). In reality, however, the reception and reaction processes are extremely diverse. We examine first the reception processes, dividing them into four subsystems: respiratory, digestive, dermal, and informational.

Through our respiratory system we interact with a wide variety of inorganic and organic stimuli. Most inorganic material is either integrated into the body tissue or expelled, without noticeable trauma. In the course of our cultural evolution, however, the increasing exploitation of fossil fuels has led to a significant increase in the inorganic stimuli to which we are exposed. Exposure to higher levels of carbon

monoxide (29) and asbestos (43, 45), for example, has consequences which are only beginning to become apparent (37). The control of inorganic stimuli is likely to take on ever greater significance for our continuing health. Organic stimuli received by the respiratory system are responsible for a great many infectious diseases, including tuberculosis, pneumonic plague, smallpox, and influenza, and for allergic conditions such as asthma and hay fever.

The digestive system is designed to extract usable energy from a variety of foods. Both inorganic and organic inputs are required: organic as the source of energy, and inorganic in the form of mineral salts necessary for the organism's biochemical reactions. Excess or deficiency of these stimuli leads to well-recognised problems. Zinc deficiencies (54) and an excess of iron (55) have been associated with an increase in the severity of infectious diseases. The effects of vitamin deficiency and vitamin excesses have been extensively catalogued, and the serious consequences of over-nutrition, leading to obesity and the associated cardiovascular conditions, and of undernutrition, as seen in marasmus and kwashiorkor, are also well known. Another common type of disorder arises from sensitivity to a specific dietary stimulus: this may take the form of an allergy to certain foods (as in celiac disease) or the inability to digest certain foods due to the inherited lack of an essential digestive enzyme (as in lactase deficiency) (36)). The digestive system is also subject to stimulation by many organic pathogens. Such pathogens may be introduced from outside the body, as in the case of cholera or typhoid fever, or they may be normally harmless microbes living in the intestine which become pathogenic following a disruption of the intestinal environment (20); traveller's diarrhoea seems to be an example of the latter process (23).

Our skin, the dermal system, is also in continuous contact with the environment. It is the site of several essential physiological processes, including the dissipation of excess body heat and the production of vitamin D. By virtue of the



sites remain "localised", for example, sunburn in the dermal system, bronchial distress in the respiratory system, and lactase intolerance in the digestive system. Others, however, are integrated and become effectively "systemic" disturbances. Cardiovascular diseases and degenerative conditions result from the additive effects of stimuli from many pathways. Some of the responses of the hormonal and immunological systems are integrative, since they combat insults from a variety of interrelated subsystems.

Psychological responses are as yet poorly understood. Attention here centres on the processes by which an individual recognises that he is ill and those involved in his determination to regain health. As has become increasingly clear in psychosomatic studies, there is a close link between those psychological processes and the individual's physiological responses (39).

Cultural responses to disease differ from physiological and psychological responses in that they occur outside the body of the individual organism. They take the form of alterations in the environment, and specifically the superorganic environment. When there is an outbreak of disease, attempts to screen the appropriate inorganic or organic stimuli may be intensified. Medical practices may be introduced to augment the body's physiological and psychological resources. There is, however, growing concern about the so-called iatrogenic diseases which are direct or indirect results of medical treatment (14). Users of thalidomide, chlortetracycline, and oral contraceptives have experienced unlooked-for effects.

If the resources available to all these possible responses are sufficient, the organism will survive. For example, the disease may be terminated if the pathogen is eliminated from the body or from the surrounding environment. In other cases, the disturbing stimulus may simply be incorporated into the system; where this is successfully achieved, the resulting condition could be called disease only in the strictest sense of the term. If the available resources are insufficient, death will ensue unless external factors restore the disrupting stimulus to an acceptable level.

intricate network of nervous tissue which it contains, it monitors a number of inorganic stimuli, among them temperature and solar radiation. To other stimuli it acts as a physical barrier, preventing their entry into the body. However, there are a number of organic stimuli which succeed in entering the body through the dermal system. Schistosomes actively bore through the dermal layer, while malaria and yellow fever pathogens are injected through the skin by insects.

The informational system is probably the least understood of the four receptor systems. It receives stimuli from two sources: symbolic communications from the cultural environment; and information from the other three receptor systems regarding the stimuli with which they are in contact. Once again, both too much and too little information lead to disorders of the system. The effects of too little information are probably to be seen in the psychological difficulties of institutionalised children (22), while an overload of conflicting information has already been mentioned as a likely factor in the development of schizophrenia.

Integration and Response

The organism is a dynamic, homeostatic system. It monitors

its environment continually and seeks to accommodate itself to the various stimuli which interact with its receptor systems. The process of evaluating the stimuli and determining the appropriate response is essentially one of integration. Stimuli which fall within the range to which the organism is adapted cause little or no disturbance to the homeostatic state, and demand a minimal response. Stimuli which cause considerable disruption of the organism on the other hand, will elicit a correspondingly larger response (49).

For our purposes, we have divided the reactive capacities of the human organism into three systems: the physiological, the psychological, and the cultural. However, it should be stressed that these systems are not separable; there is overlap and integration between them. All the systems are open and highly linked, and it is not unusual to find that a stimulus which is integrated in one system causes disease or maladaptation in another system.

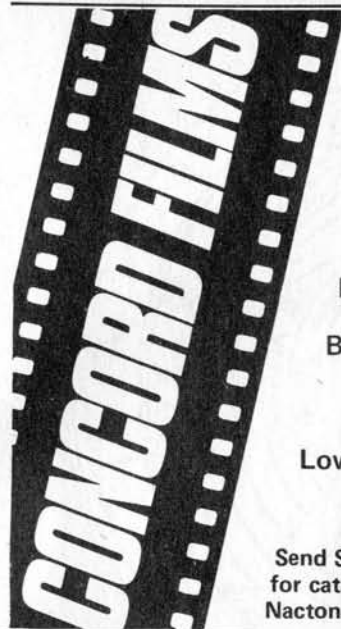
The physiological system may be divided into two subsystems, the primary receptive subsystem and the secondary integrative subsystem. Either subsystem may be affected by adverse stimuli. Some of the diseases affecting primary reception

Application

The ecologically based model that we have outlined can readily be applied to the analysis of problems of health and disease in human populations. The strength of the model is that it isolates and integrates the contributions of the factors participating in the disease process: the environment, the body's reception systems and the responses of the organism.

In the past, different conceptions of disease have arisen to meet the needs of the different workers involved with health-related problems — the clinician preoccupied with the individual patient and the diagnosis of disease, the scientist studying the biological processes associated with the disease state, and the epidemiologist examining the interactions between disease and populations (30). By adopting the ecological perspective it is possible to isolate disease factors which are of common interest.

In clinical medicine, the model provides an understanding of contemporary diseases. For diseases in which a pathogen has been isolated, it gives a means of visualising the interrelationships of the numerous factors which influence the course of the disease. Where no pathogen has been isolated, it suggests the possibility of a multifactorial origin of the disease. Atherosclerosis, for example, can be analyzed in terms of the various inputs: organic imbalances such as excess fats, sugars, etc.; imbalances of a cultural origin such as internalized aggression, ambition, or tension; and potentially harmful inorganic materials such as tars from cigarettes. The large number of possible interactions between these variables, and with others such as the genetic make-up of the individual, helps to explain the persistent failure to explain the disease in terms of a single factor. Likewise, the model can be applied to certain cancerous conditions which have long defied classification. Burkitt's lymphoma, a carcinoma common among West African populations, has been linked to immunological imbalances stemming from persistent parasite insults: malaria parasites stimulate and eventually overburden the lymphatic system, creating condi-



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tions predisposing to the lymphoma (11).

Epidemiologists will find that the model can easily be adapted to the study of prehistoric and historic populations. Evolving disease patterns through human history can be considered in terms of the changing relationships between the components of the model. The relative importance of inorganic and organic stimuli can be analyzed, as well as the efficiency of the superorganic as an environmental screen. Evolutionary changes in the various receptor systems following exposure to newly arising stimuli can be modeled. For example, dietary changes associated with the evolution of agricultural systems will make new demands on the digestive system. Increasing population size and density can be examined in terms of the consequent increase in the number of pathogens received by the respiratory system. The use of clothing would alter the interaction between the dermal system and the environment in various ways: for example, ultraviolet radiation would be screened but other factors, such as disease-bearing body lice, might be increased. Rapidly accelerating cultural complexity can be seen to affect the individual both as an increase in the strain upon the informational receptor system and in the form of changes in the psychological and physiological responses of the organism. As can be seen, the model suggests a number of lines of enquiry for an evolution-

ary study of disease.

To summarise, the traditional approaches to an understanding of the disease process in human populations have been limited by their failure to adopt an ecological perspective. Using the ecological approach, we have been able to construct a model of the disease process which gives an integrated account of the interactions of the individual, the environment, and the population. The model should be useful in predicting the outcome of specific disease situations in clinical medicine and in epidemiology, and also in reconstructing the past disease experiences of human populations.

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The Family Basis of Social Structure

(Part II)

by Edward Goldsmith

In the first part of this paper (*The Ecologist* Vol 6. 2. January 1976.) the author discussed the general principles governing the behaviour of natural systems. In this part he examines how these principles apply to the family and shows that they are the basic units of social organisation without which there can be no community.

The Family, a Definition

Until recently it has been fashionable to maintain that the original unit of human organisation was the *primaeval horde*, like that of the baboons. This is one of Freud's¹ assumptions (also Trotter's²) and is implicit in his theory of man's social development, which began when the sexually deprived bachelors rose against their overbearing Pasha-like fathers. This myth was exploded by Malinowski,³ who writes:

"Very often it is assumed by anthropologists that humanity developed from a gregarious simian species and that man inherited from his animal ancestors the so-called 'herd-instincts'. Now this hypothesis is entirely incompatible with the view here taken that common sociability develops by extension of the family bonds and from no other sources."

Murdock⁴ also regards this principle as fundamental:

"Unlike the ants and bees, man is not biologically a social animal equipped by heredity with prepotent capacities for complex associative life, but in every individual case must be bent and broken to group living through the arduous process of socialisation and be kept in the paths of conformity through the imposition of social controls. The first anthropologist fully to appreciate this basic fact was Malinowski with his emphasis upon the factor of 'reciprocity' in the maintenance of norms of interaction."

Tinbergen⁵ comes to the same conclusion looking at the problem from a very different point of view; he writes:

"Contrary to current thought, there is not in my opinion a social instinct in the sense in which we normally understand it. There are no special activities which we can call social and which do not already form part of some other instinct. There is nothing to make us believe that there is at work a system of centres controlling social activities."

In other words, the information and corresponding instructions that will make man a family animal are transmitted from one generation to the next; while those that will make of him a social animal must be developed during the process of

socialisation. That is what education is for — a fact which our educationists have long lost sight of.⁶ *The information necessary for man to become a social animal is of a cultural nature, rather than a genetic one.* However, since the total information pattern that will determine the behaviour of a social system constitutes a single whole, organised hierarchically from the general to the particular, (the latter information having developed from the former by the process of differentiation), *it must follow that the general instructions that have made of man a social animal must be derived from those that made of him a family animal.* What is more, by virtue of the rules of behavioural development, one must also assume that these instructions will *provide serious constraints on the range of possible adaptations.* It is for this reason that we find the same cultural strategies exploited over and over again in parts of the world that have had no contact with each other, just as is the case with biological strategies, hence cultural convergence.

The functions fulfilled within the family are designed to satisfy all its members..

The Universality of the Human Family

Before we follow this line of argument any further, we must establish that *the family is universal among stable societies*, otherwise, in terms of the basic principles of development stated above, no society would be possible. The universality of the family was established by Murdock⁷ on the basis of a sample of 250 cultures, figuring in the Yale Cross-Cultural index. This assumes his definition of the family as satisfying "sexual or reproductive, educational and economic requirements."

Are there any exceptions to this principle? The one usually advanced is that of the Nayers of the Malabar coast, in what is now the Indian state of Kerala.⁸

The Nayers are a matrilineal and matrilocal people. They live in extended matrilineal families run by the oldest male (*karanavan*). These extended families are organised into lineages. In the old days, every two years, these would hold a grand ceremony at which all the girls who had reached puberty would be ritually married with men drawn from specific lineages with which theirs were linked. At these ceremonies the girls were presented with certain ritual gifts including a gold necklace referred to as a '*tali*'. Following the ceremony, the girls were isolated with their husbands and deflowered, though this was apparently not a necessary part of the ceremony. Thenceforward the girl's status changed. She was called '*Amma*', meaning mother, and allowed to have children — not by the ritual husband who need have no further contact with either her or her children, but by her lovers. These were referred to as '*sambadham*'. She could have as many as she liked though they had to be of the appropriate sub-caste and outside her lineage. When she became pregnant it was essential that one of them should acknowledge probable paternity, which was done by providing a fee of a cloth and some vegetables to the midwife. If no such acknowledgement was forthcoming it was assumed that the girl had had relations with a man of lower caste or with a Christian or a Moslem. This meant her expulsion from her society. The duties of the '*sambadham*' from then onwards were limited to providing his mistress with gifts at festivities. He had nothing to do with the maintenance of the mother or the upbringing of the child, which was the duty of the '*karanavan*', the chief male matrilineal relative. The children's duties to the '*tali*' husband were limited to mourning at his death. The '*sambadham*' — whether the progenitor or not — were addressed as '*accahan*' or Lord, but with no kinship terms extended to their family and no mourning was observed at their death.



This organisation has defied customary classification. Many have maintained that it provides an exception to the principle of the universality of the family. Others (Murdock included) doubt whether this account of Nayar organisation is authentic.

The reason why it presents a classificatory problem is that our method of classification is wrong. We are accustomed to think of the family as consisting of a father, a mother and some children, with possibly one or two grandparents attached. Instead we should think of it *in terms of the functions it fulfils. The family would then be present, if the family functions were fulfilled by individuals, biologically and culturally adapted to do so.* The community as a whole or a specialised institution would not qualify, for a family is a differentiated system at a particular level of organisation. Its functions must be fulfilled by individuals — and specific ones at that. The point is, however, that they need not all be fulfilled by the same set of individuals.

For *different* functions, in fact, the family system (seen functionally) can consist of a *different* set of individuals. Thus the first family function is to engender the child. Associated with this is that of satisfying sexual needs. Among the Nayars, the family system whose normal functioning achieved these ends was composed of a girl and the 'sambadham'. Parents are required for bestowing on their children the parental care and affection they need and for the task of instilling in them the basic cultural

values and teaching them the fundamentals of the tasks they will have to fulfil in later life. Among the Nayars, this function was fulfilled by the mother and her matrilineal lineage headed by the 'karanavan'. Last but not least a child requires an identity or a social status, the basis of which the family alone can provide — a point neglected by Murdock is his definition of the family. This was achieved by yet a third social system, that composed of the girl and her 'tali' husband. Thus, the essential family functions were fulfilled in the case of the Nayar *by three different social groupings*. If we regard this as abnormal, it is only that in our Western society they tend to be fulfilled (in so far as they are fulfilled at all), by a single social grouping which we call the family.

What is more, it can be shown that the same principle holds for larger groups than the family. Thus, after reviewing the different criteria for determining what constitutes a political unit, Lucy Mair⁹ writes, "There are some societies of which it is difficult to say that there is one political community for all purposes." Thus a tribe which is often endogamous and hence the unit of behaviour for marital purposes, is divided into different lineages which are often the effective units of political life, which may or may not, correspond with the village which will be the unit of behaviour of a large number of social and economic functions, etc. In addition, the men in particular will be divided into age groups, each with a particular function, which in turn may form part of wider age classes — the young, the adolescents and the elders. Furthermore there will tend to be secret societies which are units of behaviour for magical and ritualistic purposes and working groups which will be the units of behaviour for various economic functions.

How is the Family Held Together?

The functions fulfilled within the family are designed to satisfy the needs of all parties concerned. Thus a father *needs* to behave in a fatherly way as much as a child requires that his father should do so (see the Hierarchical Co-operation Principle). The members

of the family are thereby dependent on each other. It is this dependence which provides the bonds that hold it together.

There are a number of different family bonds. The bonds that hold together a father with his daughter, a mother with her son, a mother with her daughter, a man with his younger brother, a girl with her younger sister, a brother with his sister — these bonds are all very different and *asymmetrical*. The relationship of a father to his daughter for instance is very different from that of a daughter to her father.¹⁰ That of the father to his children is even more noticeably different from that of the mother. According to Fromm,¹¹ "The love of the mother for her child, antecedent to that of the father, appears to be an unconditional love, whereas that of the father is conditional on the child's 'good' behaviour or achievements."

This is reflected in the different relationships between a society and the gods it worships. It is no coincidence, as Fromm points out, that the more undisciplined and self-indulgent cultures turned to a mother goddess, whereas more virile peoples who, wishing to be judged according to their moral worth and their achievements, chose a paternal symbol as their chief deity. This tendency could not be better illustrated than by the social circumstances that in ancient Egypt governed the rise of the cult of Isis and the corresponding decline of Osiris, and in Christendom the development of the cult of the Virgin Mary beginning in the anomie of the 4th century and its abandonment by (I think one can say) all those 'revitalisation' movements that culminated in the Reformation.

What is important is that the basic difference between these bonds is exploited to determine culturally differentiated behaviour. In all traditional societies known, there is a clear division between the social function of men and women as there is between members of different age grades. *It is only by maintaining this differentiation that co-operation as opposed to competition is possible and that the society can display*

order or negative-entropy.

The Exploitation of the Family Bonds

The fact that we tend to classify our social and physical environment in terms of the classificatory system applied to the different members of the family, should be evident from our personal experience.

Tinbergen¹² shows that we view our domestic pets in this way. Dogs with snub noses and high foreheads are particularly popular among women requiring a child surrogate. Similarly, behaviour towards political leaders can only be understood if the latter are interpreted as fathers, husbands, lovers, sons, grandsons, brothers, etc. One whose image does not permit such classification has little political future, indeed.

Even consumer products are regarded in this way. A camera with a huge telescopic lens dangling over the belly of a dashing young photographer is clearly regarded as an extension to his penis by admiring girls. In this connection, I remember a cartoon of a dapper little man with a pince-nez hesitating at the motor-show between a staid family model and a fast sports car. The salesman was saying "Well, Sir, it all depends on whether you want a wife or a mistress."

The fact that we regard the gods we worship as fathers, mothers, and children has already been pointed out. The individual people making up a community are no exception to this rule.

Kinship Terminology

The fact that the family bonds are extended to embrace the members of the community is reflected in the kinship terminology developed by tribal societies, in terms of which the whole community can be classified. In this way these classificatory systems, as Radcliffe Brown¹³ points out, "may be applied over a wide range of relationships. Thus a first cousin of the father, being his father's brother's son, whom he therefore calls 'brother', is classified with the father and the same term 'father' is applied to him. His son in turn, a second cousin, is called 'brother'. By this process of extension of the principle of classification, nearer and more distant

collateral relatives are arranged into a few categories and a person has many relatives to whom he applies the term 'father' or 'mother' or 'brother' or "sister".

The most important feature of these classificatory terminologies was pointed out long ago by Sir Henry Maine.¹⁴ 'The effect of the system,' he wrote, 'is in general to bring within your mental grasp a much greater number of your kindred than is possible under a system to which we are accustomed.' In other words, the classificatory terminology is primarily a mechanism which facilitates the establishment of wide-range systems of kinship."

What is more, "the attitude and behaviour of a person towards a particular person," as Radcliffe Brown¹⁵ points out, "is affected not only by the category to which he belongs, but also by the degree of nearness or distance of the relationship. In classificatory systems there are many women whom a particular man calls 'sister'. In some systems he will be prohibited from marrying these women. In some others he may not marry any 'near sister', i.e. any of these women who is related to him within a certain degree of cognatic relationship, but may marry a more distant 'sister'.

Now if people are referred to by different names, there must be a reason for it: and the reason appears to be that these names reflect expected differences in behaviour by and towards the people they refer to. This is also the conclusion of Radcliffe Brown¹⁶: "I hold that all over the world there are important correspondences between kinship nomenclature and social practices."

Elsewhere, he is still more explicit.¹⁷ "The general rule is that the inclusion of two relatives in the same terminological category implies that there is some similarity in the customary behaviour due to both of them, or in the social relations in which one stands to each of them; while, inversely, the placing of two relatives in different categories implies some significant differences in customary behaviour or social relations."

In this way, a tribal society is regarded as a differentiated system,

and this must contribute profoundly to enabling it to become so.

The Community

If the family is universal, so is the community.¹⁸ This is basically a group of families living together. It occurs in every known human society (even among the Eskimoes, who, though they live in family groups throughout the summer, gather together with other family groups during the winter months).¹⁹ Communities have gone under various names. Among nomadic hunter gatherers, who have made up probably more than 90 per cent of the people who have ever lived on this planet, they tend to be referred to as bands. They differ from the communities of sedentary peoples in that they tend to be less permanent. Communities can be made up of anything from fifty to a thousand or so people. The upper limit is set, in the words of Linton,²⁰ by "the practical impossibility of establishing close contacts with and developing habitual attitudes towards any greater number of people."

How are the family bonds exploited to hold together the community and to give rise to still larger social units?

The Clan

One such device is by dividing a society into clans which can transcend other groupings. The clan, according to Murdock²¹ appears to be present in at least half the traditional societies examined. "Whereas the community is made up of consanguinal and affinal relatives, the clan will be made up of consanguinal ones, either traced on the mother's side (matriclan), on the father's side (patriclan), or very occasionally via the uncle (avunculan). Both groupings will be made up of people of different sexes and of different age groups held together by a complete set of family bonds. It is not surprising that they will tend simply to be replicas of the family unit on a larger scale.

In patrilineal and patrilocal societies, there will be a tendency towards an 'atomistic' organisation of society, with the creation of more clearly defined social units. Thus each tribesman or citizen will belong to his father's kinship group,



and will also reside among his father's kinsmen.

Lowie²² quotes a case of the Australian Deri, among whom descent is matrilineal but whose marriage is patrilocal. In this case the territorial unit exists with and is independent of the kinship unit. It is clear that as a result of this institution the different clans are closely linked to each other. Indeed, as a result of this, the Deri constitute a nation and have a paramount chief. This is not the case, however, of the Kanera, in other respects a similar people, but who are patrilineal and patrilocal. The divisions between the clans in their case are much greater, there is no paramount chief and in fact the Kanera do not constitute a political unit of any kind.

This provides an interesting illustration of the great variety of different social systems which can be built up by exploiting the basic family bonds in the appropriate way.

What is important is that whenever a full set of family bonds is exploited to create a social unit other than a family, it can only reflect the latter's structure, since the family provides the only model for holding it together.

Larger Society Reflects Basic Communal Structure

In traditional tribal and supra-tribal groupings, when the social unit is larger than the local community, secondary groupings clearly reflect the basic ones of family, clan and tribe. In Athens, the army was originally organised in exactly the same way. In the Iliad we find

Nestor reminding Agamemnon of the rule to dispose of his men by tribes and phatries: "that phatry may assist phatry, and tribe assist tribe."²³

According to Glotz,²⁴ "all the public services, whether one considers the army, the navy and what one must call the exchequer, respected the natural groupings, without which the city could not exist."

Basic social structure was also reflected in the structure and form of tribal and supra-tribal groupings, as pointed out by Linton. The Iroquois, for instance, had a single basic pattern of formal control which extended from the household through the clan, village and tribe to the League itself. They themselves recognised this continuity, referring to the League as the Long House and emphasising its similarity to a household.

Linton writes²⁵: "The patterns of confederate governments are almost without exception, projections of those of the tribal governments with which their members are familiar. While these patterns always have to be somewhat modified to meet the new conditions, there is a clearly recognisable continuity."

Settlement Patterns

An important means of assuring social cohesion is for the social structure to underly all basic activities. In traditional societies there are very well defined laws of residence. These will largely determine the nature of the bonds linking one to another and, thereby, the character of the community. Whatever be these rules, the members of the community will be related to each other, or at least, and this is more important, they will *regard* themselves as related to each other.

The arrangement of the houses in a traditional village reflects its social structure.²⁶ That is why transforming a local village so that it conforms to the Western model and forcing the inhabitants to live in modern housing estates or townships causes such terrible social disruption. This is pointed out by Levi-Strauss²⁷ with reference to the Bororo of Brazil and also by Robert Jaulin²⁸ with reference to the Motilone Indians on the frontier between British Guiana and Brazil.

Land Tenure

The same principle applies to land tenure. A man has a right to a specific piece of land because of his specific position within the social group. In ideal conditions the pattern of land tenure reflects a society's social structure.²⁹

In all cases, as Sir Henry Maine pointed out, *the land is an aspect of the group, but not the basis of grouping*. A man does not derive his status from ownership of a piece of land, but rather obtains ownership of a piece of land by virtue of his status. Land tenure, in fact is based on *status* not on *contract*. Since this status reflects a man's exact position in his society's social structure, the latter must be faithfully reflected in its principles of land tenure.

Economic and Social Units Coincide

Not surprisingly, in a traditional society, the units of economic activity tend to coincide with those into which man is organised for all other social requirements. With us a man's social position is to a certain extent, and possibly increasingly so, determined by his economic position. In a traditional society it is the other way around. "He tends to hold his economic position in virtue of his social position. Hence to displace him economically means a social disturbance."³⁰

In general, basic social structure underlies the organisation of the traditional community and is reflected in all its activities. This was undoubtedly the case in Rome until late into the history of the Republic. However, in the Classical world, rapid changes occurred which made survival of traditional forms increasingly difficult. Societies became bigger, empires were established, mobility increased, and certain activities, such as warfare, trade and industry, began to play so important a role that the natural balance of traditional societies became seriously impaired. As this occurred normal rules of residence determining the social structure of communities and their relationship with other key groupings, such as the clan, became subordinated to new, usually economic considerations. Social order gave way to social randomness or entropy. The basic

units of society ceased in this way to be highly differentiated and self-regulating natural systems and increasingly became random groups or individuals held together by what bond is afforded by sheer contiguity and via the agency of governmental institutions, i.e. asystemic controls. In Athens, this situation led to the famous reforms of Cleisthenes in 409 B.C. by which the *deme* became the basic administrative unit of the Athenian State.

In the same way the Roman *gens*, originally a kinship group, eventually became a territorial one, though the fiction of common ancestry was for a long time maintained.

Among the ancient Jews the same reforms were made by King Solomon.³¹ The country was divided into territorial units which did not in fact coincide with the ancient tribal territories. Some of the tribes in fact only appeared to come into existence in this way, since they appear to have been named after the district which they occupied (Gilead, Benjamin, Ephraim). Thus, Lods³² writes, "The early grouping, based originally on consanguinity (natural or artificial), tended to become territorial aggregations. The clan finally became synonymous with the population of a town . . . Membership of a tribe consisted not in descent to a particular individual but in belonging by birth to a particular territory. Once settled in Canaan, the Israelites soon reached the stage of the peasants of Khorassan, of whom the Arabs say contemptuously: 'their villages are their pedigrees'. Calif Omar urges his Arabs to preserve their pedigrees and not to become like the peasants of Iraq, who, to the question, 'Whence art thou?' (i.e. from what tribe?), were wont to reply, 'from such-and-such a village'."

Thus, among the Jews Lods tells us that even after the establishment of the tribes as geographical units, "the tribes also retained their faith in genealogies, however fictitious these might be, and in their rival claims to pre-eminence, as exemplified for instance in the arrangement of the sons of Jacob in the official genealogy and in the jibes directed against various tribes in certain early poems."

As Lods points out, rather than accept the facts of new social groupings, they "imposed their own social framework upon the population of the country."

It is probable that as these territorial associations ceased to reflect basic family structures, they ceased thereby to constitute viable social units, for it meant that the bonds capable of holding them together could no longer be fully exploited.

The members of a traditional society are linked in a veritable cobweb of relationships

Secondary Groupings

The extension of the family bonds to link together all the members of a stable community requires the exploitation of still more subtle culture devices. These include, most notably, binding it together with a veritable cobweb of secondary associations of different sorts.

Durkheim³³ fully realised that a society can only be held together if it be organised hierarchically into groups and sub-groups, that a society, in fact, can only be built up by associating smaller units among which effective bonds can be created, and that these bonds are necessary not only to create the societies, but to satisfy the requirements of their individual members (the Hierarchical Co-operation Principle). Thus, he writes, "A nation can be maintained only if, between the state and the individual, there is intercalated a whole series of secondary groups near enough to the individuals to attract them strongly in their sphere of action and drag them, in this way, in to the general torrent of social life."

The absence of these 'secondary groupings' is one of the principal reasons for the instability of the modern nation state.

Durkheim was particularly impressed with the structure of Roman and later Mediaeval trade associations. Indeed, Roman trade guilds

were formed on the same model as the kinship group of family and *gens*, with a religious centre and a patron deity. They were referred to as *Collegia* dedicated to Minerva, the goddess of handiwork. Their development is traced very carefully by Durkheim.

According to Waltzing,³⁴ the guilds were primarily religious organisations. "Each one had its particular god whose cult was celebrated in a special temple when the means were available. In the same way as each family had its *lar* and *familias*, each city its *genius publicus*, each organisation had its protective god, *genius collegii*."

"Naturally this occupational cult did not dispense with celebration, with sacrifices and banquets in common . . . As corollary to this religious character, the organisation of workmen was, at the same time, a burial society. United in a cult during their lives, like the Gentiles, the members of these populations also wished to rest together after death."

Durkheim³⁵ then asks, "A common cult, common banquets, a common cemetery, all united together — are these not all the distinctive characteristics of the domestic organisation at the time of the Romans? Thus it has been said that the Roman population was a great family. The community of interests took the place of a community of blood." As Waltzing³⁶ writes, "The members looked upon themselves as brothers even to the extent of calling themselves by that name . . . The protectors of the organisation often took the names of father and mother."

The division of a society into age grades is common to most traditional societies. This division plays an essential role in education, as it is in proceeding from one age grade to the next that a child is subjected to the different influences in the appropriate order that will ensure its socialisation or education. At the same time, and by the same token, the different age grades provide the basis for the fundamental specialisation of functions within a traditional society. Thirdly, membership of a common age grade creates one of the most powerful social bonds. As Lowie writes³⁷: "Simul-



taneous initiation creates ties transcending the bonds due to equal status."

The bonds exploited to hold together age grades can only be those which hold together brothers of the same family. Indeed, as could be expected, their members refer to each other as brothers.

Among warlike societies a strong social bond is that existing between different members of the same military clubs who also regard each other as brothers as do members of secret societies, whose role and importance varies among different peoples.

Criss-cross Linkages

In this way every member of a community will be closely associated in some way with every other member, for if a person is not associated with another by being a member of the same family, or clan, he is certain to be associated with him by belonging to the same military group, secret society, etc. The members of a traditional society are thereby linked in a veritable cobweb of relationships in which all must be caught up in some way. A man has a status in each of the groupings to which he belongs and in any society his total status is, as Linton³⁸ writes, "the sum total of all the statuses which he occupies. It represents his position with relation to the total society." As a result of this particular structure of society, a man has a very definite status, which he lacks in a mass society such as ours.

This lack of status from which man suffers in mass society is what Durkheim calls 'anomie'. It

is the same phenomenon as that which Marx and others have referred to as alienation — or loneliness in a desert.

Each individual in a tribal society is a highly differentiated member of the society and, as a result, the society functions as an effective system made up of differentiated parts. Modern mass societies, by contrast, are merely assemblies of undifferentiated individuals held together by common institutions.

The Role of Religion

In our areligious age, the importance of religion as a means of maintaining a society's social structure, and thereby ensuring stable government, is grossly underrated.

We forget that, in a traditional society, religion is very much part of a society's culture, so much so as to be undisassociable from it. Indicative of this is the fact that there is no word for 'religion' in the language of traditional societies. There is simply no need for it. 'Religion' simply meant 'matters of state' — and it never occurred to anyone that these could be dealt with on any basis but that which we would refer to as religious. Why is religion so important? One of the answers is that the elaborate social structure of a traditional society could not be maintained if it were not sanctified, i.e. provided with a divine or supernatural protection. Empirically, this can be verified, since there is no instance of anything approaching a stable society among people who were not deeply religious, and whose religion was not an integral part of their culture, serving to regulate their behaviour towards their social and physical environment. In order to sanctify a society's social structure the gods must be organised in such a way that they faithfully reflect it.

On this subject Francis L. K. Hsu³⁹ shows that among the Chinese "... the world of spirits is approximately a copy of, and strictly a supplement to, the world of the living." The same is true among all traditional societies. The family, the tribe, and other social units were thereby religious units as well as social ones.

The important role played by the father in most traditional societies

is largely due to his position as priest of the family cult, just as the importance of the tribal chief lay in his position as high priest of the tribe and that of the king in his position of high priest of the association of tribes, as in the case of the ancient city state.

It is extremely important to realise, as well, that by identifying a society's gods with its ancestors, so does it maintain its essential continuity. Among the inhabitants of disintegrated societies, the dead are considered to have migrated to a different world, which is considered to have little in common with the one in which people live. Often it is only by postulating this very different world and by cherishing the thought that one day they will graduate to it themselves, that their miserable existence on earth is thereby rendered tolerable. The opposite is true of a tribal society which, on the contrary, is said to be made up of the living, the dead and the yet to be born — which has, in fact, total continuity.

It is interesting to note, too, that as a society disintegrates so does the structure of its pantheon. The principal god finds himself isolated. Instead of being but *primus inter pares*, he is now alone and reigns supreme. Also, with the disintegration of its culture, the society loses precisely those features that distinguish it from its neighbours, and as a result, the realm of the principal god slowly spreads. From being a tribal god, he gradually develops into a universal one. As this occurs so does religion lose its social functions. Slowly it simply becomes an institution for providing solace to increasingly alienated individuals.

The Social Stability of the Physical Community.

The fundamental importance which primitive man attaches to the structure of his society is reflected in his tendency to attribute to it some sort of 'absolute reality'. He cannot conceive of any part of his environment as not being organised in a similar fashion. The natural world, as Durkheim and Mauss have shown, is therefore made to reflect this structure.⁴⁰ In this way, he classifies his total environment, physical, social and supernatural, in terms of the same classificatory system permitt-

ing the building up of an integrated world-view, in terms of which can be mediated a single integrated behaviour pattern.

However, if his social structure is eroded — and in particular the family system upon which it is based, this classificatory system must thereby cease to be available — and separate largely egocentric systems will come into use on the basis of which it is impossible to mediate a single integrated behaviour pattern — but only a patchwork of expedients — as is the case with us.

Conclusion

To understand the true function and importance of the family, it is important to view it cross-culturally and cross-behaviourally, and in terms of the basic theoretical principles underlying the behaviour of natural systems at all levels of organisation — i.e. in terms of a General Model of Behaviour, embryonic though it may be at the present time. In doing this it becomes clear that the family is the basic unit of social behaviour. This means that its development constitutes the earliest, most general and most important phase of the process leading to the development of a society and its renewal with each generation — a process we can refer to as 'sociosynthesis'. This stage will colour all subsequent ones (the Generality Principle). If it does not occur, then the process as a whole will not occur — or, more precisely, it will not constitute an integral whole, which is required if it is to be adaptive, i.e. if it is to tend towards stability (the Sequential Principle).

Seen slightly differently, as 'sociosynthesis' proceeds, so new levels of organisation are achieved. As in phylogeny, a higher level cannot be achieved without first passing through the intermediary ones. Thus, if there is no cell there can be no biological organism. *In the same way, if there is no family, there can be no community.*

By examining the process whereby families are associated to form a community, we see why this must be so. Firstly, it is only by exploiting that set of asymmetrical bonds which link together the different members of the family, that the members of a community can also

be associated to create an effective community. Secondly, it is only in terms of that classificatory system applied to the different members of the family, that members of the community can be classified, and that, as a result, the community can be viewed as a differentiated system, and hence as a system displaying a high degree of order or negative-entropy.

It is also in terms of the same classificatory system that a society's gods and also, to a certain extent, its physical environment are classified. *It is only in this way that a society's world-view can provide it with a single integrated model of its relationship with its total environment.*

This classificatory system, as we have seen, is that used to classify the different members of the extended family, and it inevitably breaks down with the latter's disintegration. As this occurs, the society increasingly comes to be regarded as consisting of largely independent individuals. This leads to the progressive erosion of those constraints which must be imposed on the individual's behaviour if it is to be compatible with the survival of the family and the community. As attitudes change, the physical environment, instead of being seen socio-centrally, comes to be regarded egocentrically in terms of its capacity to satisfy individual (heterotelic) needs.

At the same time, the gods become increasingly concerned with providing catharsis for socially deprived individuals and lose their socially and ecologically stabilising functions. As a result, the society, and likewise its relationship with the environment, are deprived of their continuity. In fact, the society fundamentally ceases to constitute a system at all — but simply becomes a mass of socially unrelated individuals among whom a semblance of order, however superficial, can only be maintained by means of increasingly powerful external or asystemic controls — bureaucracies, dictators, etc.

For basic cybernetic reasons, such a society cannot be stable. It can only head in the direction of further disintegration and eventual collapse.

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The Politics of Soil Conservation

by Erik Eckholm

In his relations with nature, as in his relations with his fellows, man appears to be a poor student of history. Despite the all too visible diorama of ruined landscapes and abandoned civilizations, mistakes of the past seem time and again to serve as models instead of usable lessons. Deaf to the almost daily warnings of some looming new ecological threat, governments and individuals rarely change their habits accordingly.

Studies of human-caused environmental degradation sometimes leave an aftertaste of near-misanthropy. How can people destroy the basis of their own survival? Given the record, it is tempting to blame the continuing devastation on human ignorance or stupidity. If the technical solutions to environmental degradation, nearly always known and publicized by scientists, were really just that — technical solutions — then this assessment of human knowledge and aptitudes might suffice as an explanation of the current environmental malaise. In some ways, at least, this would be an encouraging conclusion, suggesting the potential to solve these problems fairly easily and quickly through technocratic dictatorship.

For better or worse, however, the application of technical answers to ecological problems almost never turns out to be simple. Scientists and development planners work out elaborate schemes for rural regeneration, but peasants and goats seldom seem to find it in their own interest to assume the profile of the computer cards they are dealt. It may be useful to discuss more systematically some of the many factors — the constellation of influences that must ultimately be termed political — that help propagate suicidal land use in the face of scientists' warnings.

Land-use patterns are an expression of deep political, economic and

cultural structures; they do not change overnight when an ecologist or forester sounds the alarm that a country is losing its resource base. In many countries, the deterioration of the land will not be halted until basic changes in land tenure and national economic priorities occur. This point is starkly illustrated by the story of an Ethiopian reforestation project.¹ Peasants whose personal prospects for progress were smothered by feudal land-tenure and social structures sabotaged a programme to restore the land by planting tree seedlings upside-down. The immediate cause of this non-violent rebellion was apparently the sub-standard (by local norms) level of wages the labourers were receiving. But, had the workers believed that an improvement in the land's quality would seriously improve their own welfare and that of their children, their behaviour almost certainly would have been different.

In his study of El Salvador, Howard Daugherty documents other ways that land-ownership and usage patterns can influence ecological trends.² El Salvador is one of the most environmentally devastated countries of the New World. The tropical deciduous forests that once covered 90 per cent of the country have been totally destroyed by centuries of clearance for grazing, plantations, mining, charcoal manufacturing, and, especially within the last century, the spread of subsistence cultivation. Soil erosion has

sapped fertility throughout much of the countryside, but above all on the extensive upland hillsides. A recent study by the Organization of American States concluded that 77 per cent of El Salvador's land area is suffering from accelerated erosion.³ Nowhere has the damage been more extensive than in the country's northern mountains, which were originally covered with dense forests. Long subjection to heavy cultivation and grazing has largely destroyed this range's topsoils, reducing many hills to a rocky, barren moonscape. While cultivation and grazing continue in this depleted zone, its reduced fertility has been a major cause of the heavy emigration of El Salvadorians into neighbouring Honduras that helped precipitate a war between the two countries in 1969.

The obvious catalyst of El Salvador's environmental decay in this century has been the dizzying growth in human numbers. The population of 775,000 in 1900 doubled by 1940, redoubled by the mid-1960s, and is currently in the process of doubling again within the space of just 22 years. El Salvador's population, the densest on the mainland of the Americas, guarantees heavy ecological pressures, especially since the majority wrest their living from the soil.

Behind the aggregate figures for population growth and land damage are some revealing statistics that more completely explain environ-

mental trends. The pattern of land ownership is unquestionably a major contributor to ecological stress. *Latifundia*, large estates devoted to ranching and commercial crops, have been deeply entrenched in El Salvador since the Spanish occupation nearly five centuries ago. As of 1961, less than 1 per cent of the country's farms were over 100 hectares in size, but they occupied 48 per cent of the agricultural land. At the other end of the scale, 47 per cent of the farms were smaller than one hectare, and constituted less than 4 per cent of the total farming area. The trend of recent decades has been a perpetuation of the large holdings and increasing fragmentation of the smaller farms.

The *latifundia* occupy El Salvador's most fertile and productive lands — the middle volcanic slopes, the interior basins and river valleys, and much of the coastal plain. Because of the export-market orientation of the *latifundia* owners, a third of El Salvador's crop land is annually planted to coffee, cotton and sugar cane. Meanwhile, hundreds of thousands of subsistence farmers, struggling to grow food for their families, are crowded onto the remaining land. All arable land has already been put to the plough, driving farmers onto slopes where erosion may require abandonment after a year or two of cultivation, and ensuring a reduction in the fallow periods essential for maintaining soil fertility and fighting erosion. Daugherty sums up the situation:

"The increasing fragmentation of small plots and the progressive trend from shifting agriculture to semi-permanent and permanent cultivation (necessitated by the lack of additional land) has led to the widespread ecologic destruction of much of upland El Salvador, which comprises the bulk of the land surface of the country. Thus, the root of the ecologic problem of El Salvador is not only gross over-population, but the structure of land tenure as well, which has forced the intensive utilization of slope land."

If archaic, inequitable land dis-

tribution promotes suicidal uses of the land, maldistribution of economic opportunity also encourages the rapid population growth that itself has suicidal overtones. Poor, often malnourished subsistence farmers account for the greatest share of El Salvador's population growth and, judging from experience elsewhere, they are unlikely to drop their preference for large families until they enjoy improved economic security and social conditions. Inequitable social structures, then, can help account for ecological deterioration both directly, by forcing undesirable land utilization, and indirectly by, fostering runaway population growth.

El Salvador's advanced state of physical degradation stands as a warning to many other countries — especially in Latin America, where the concentration of large land-holdings in the hands of a few is generally far greater than in Asia and Africa — in which populations are multiplying fast and skewed land-tenure structures are encouraging the rural agrarian poor to destroy their own prospects for advancement. Most poor countries are not yet so densely peopled as El Salvador, but as the population doubles in two to three decades, acute pressures are sure to develop in localized, though sometimes quite large, areas.

Haiti is among the few countries that already rival or perhaps surpass El Salvador in nationwide environmental destruction. Not coincidentally, Haiti also resembles El Salvador in its inequitable distribution of land ownership, economic opportunities and social services. It, too, has one of the highest birth rates in the Americas. Haiti which means "Green Island" in the indigenous language, is now less than 9 per cent wooded and its mountains are completely ravaged. Long a consequence of severe poverty, soil erosion has reached the point where it is now a major cause of poverty as well. The U.N. Development Programme has labelled "rapid and increasing erosion" as "the country's principal problem."⁴ Wealthy farmers and North American sugar corporations own the best valley lands, crowding peasants onto slopes where cult-

ivation is a futile, temporary proposition.

Steep slopes have been cleared by the land-hungry, and traditional fallow periods have been violated, in large areas of Asia, Africa and Latin America. National population density averages, which tend to disguise land problems, can be misleading; the exceptional sparseness of the Amazon Basin population, for example, provides little comfort to the landless peasants struggling to survive in Northeastern Brazil. Often the redistribution of better lands would hold down the encroachment on marginal areas by farmers, desperate for a plot on which to grow food, who have been shunted off good farmlands by overcrowding and inequitable ownership patterns. A recent United Nations reforestation programme near the town of Ayapel, Colombia, on formerly tree-covered slopes now suffering from severe erosion, had to be abandoned because the project area was invaded by disenfranchised squatters.⁵ The goal of ecological revival was sacrificed to the more immediate subsistence needs of the squatters, though in the long run both are life and death matters.

Without access to land in the more hospitable, productive zones, the landless may turn into vagabonds, farming wherever they can for brief spells until erosion, depleted fertility or the police drive them on. Many give up and migrate to the cities; others move to tropical forest zones, such as the Amazon Basin and parts of West Africa, where large areas lie unused by man. After learning the hard way that jungle soils are not as easily mastered as those to which they are accustomed, farmers who had hoped to settle down to a more prosperous life find themselves and their families itinerants who are forced to destroy prime forests and soils as they try to carve a living out of the unfamiliar rain forests.

The influence of land tenure on cropping patterns, as illustrated by the case study of El Salvador, reveals other widely applicable lessons about ecologically sound land utilization. Cash crops for export like cotton, sugar cane or beef are a key source of foreign exchange for many of the poorest countries,

and can play a useful role in promoting economic development if the proceeds from their sale are properly spent. Seldom, however, is close attention given to what, from the perspectives of human welfare and ecology, an optimal mix of agricultural land uses might be in countries with shortages of good farm land and widespread malnutrition. Thus, in Costa Rica, the spread of cattle ranching to supply the North American market is forcing smaller farmers onto poor quality, easily eroded lands, even as per capita beef consumption within Costa Rica drops.⁶

A narrow focus on aggregate GNP statistics and the desirability of extending the "modern economy" into backward areas may result in a heavy premium on commercial agriculture. But normal economic signals sometimes obscure the potential social and economic costs of large plantations or ranches squeezing subsistence farmers onto marginal lands, whether in drought-prone areas of Chad or on mountain slopes in Ecuador. Not only is the potential of these lands (perhaps for forestry, horticulture, grazing, tourism or recreation) destroyed by intensive and improper cultivation, but huge costs in the form of floods, reservoir sedimentation and dust storms can also result, as can an unmeasurable spread of human suffering.

When lands are best suited for a valuable export crop, ideally they might be planted to it, and the proceeds then be channelled back into economic activities that provide jobs and increasing income to the rural poor. Instead, the peasants are all too frequently left with the worst of all worlds. The more productive lands are preempted by a few local or foreign investors and diverted to crops meant for sale abroad. The profits from this commercial agriculture wind up financing the luxurious lifestyle of the local landed gentry, being remitted abroad, or, if effectively taxed by the national government, mainly being spent in the cities to support bloated bureaucracies, urban services and industrial development. Destitute subsistence farmers subsequently redouble their efforts on the remaining land, and

ecological deterioration soon accelerates, as does the flood of migrants to urban shantytowns or less compacted neighbouring countries.

The examples from Ethiopia and El Salvador each show, in different ways, why land redistribution may be the prerequisite of ecological recovery in countries with highly inequitable land tenure. Confidence in the personal benefits from land-improvement investments greatly increases the likelihood of such investments. Where the tenants are insecure, or where labourers are indentured to till the fields of another, guardianship of the long-term quality of the land can scarcely be expected. In some situations, the sheer problem of space is exacerbated by over sized estates in the hands of a small minority. Perhaps the most rigidly institutionalized examples of the latter are Rhodesia and South Africa, where the small European minorities have reserved the best lands for their own use, crowding Africans onto an inadequate land area.⁷

At the same time, however, it is naive to assume that the political act of distributing land and other social benefits guarantees ecologically sound development. As the escalating deterioration of the Bolivian Highlands since the reforms of the early 1950s demonstrates, breaking up the *latifundia* can actually exacerbate deforestation and erosion. After the French Revolution of 1789, a similar acceleration of environmental destruction occurred. Peasants and wood merchants immediately set upon the newly accessible forest reserves of the deposed feudal barons, destroying an estimated 3.5 million hectares of forest in just four years.⁸ This phenomenon leads inescapably to an appreciation of the importance of *information* on proper and improper land uses, and of *ideas* about man's relationship to the land and its future. Even where legal structures and demographic and geographical conditions exist that would permit efficient, sustainable land exploitation, an *ethic* of conservation is its ultimate guarantor.

The blending together of social reforms and an ethical ecological consciousness sets the Chinese Revolution apart from most other

major social movements of this or any century. The stress on land conservation that has permeated daily discourse in China is by no means an inevitable outgrowth of the Chinese leadership's European Marxist background. If the historical pattern of large-scale devastation is in fact being reversed in China, as the government claims and as many visitors attest, this may constitute the Chinese leadership's greatest legacy to future generations both in and out of their country. Without the massive efforts at reforestation and soil and water conservation, as well as the stringent programmes to slow population growth that have been initiated, a future of destitution and famine for the world's most populous country would have been certain.

The degree to which land ownership patterns influence ecological trends varies widely among countries; the threats posed by *latifundia* in El Salvador bear only limited resemblance to the crises of Niger, India or Nepal. There are, however, several other political obstacles to effective natural resource protection that exist in every country.

One chronic problem, with implications extending beyond environmental issues, is the difficulty decision-making institutions have in adjudicating the competing demands of the present and the future — the problem of priorities. In the face of famines, military threats, unemployment, political intrigues and other such everyday events in the average poor country, few powerful officials feel they can afford the "luxury" of devoting attention and money to a topic as seemingly esoteric as ecology. Until the environment suddenly is the major national crisis, its deterioration may occur almost unnoticed, with the costs quite real but difficult to total up. Likewise, the benefits of programmes like tree planting and sapling protection, or the sharing of soil-conserving techniques with farmers on tiny holdings, are not easily appreciated by economic planners. Both governments and the public want dramatic production gains now, not an investment of scarce funds to satisfy what may seem hypothetical future needs. Hence emphasis is placed on big

dams and canals at the expense of drainage; on clearing new farm land at the expense of reforesting depleted hillsides; and on building fertilizer factories at the expense of encouraging the preservation of soil fertility and structure with organic wastes.

Land-tenure systems as well as political considerations can promote a dangerous emphasis on the short-term future, and the subsequent effects on environmental quality are not confined to the countries with *latifundia*.

In 1951, a top-level research group in the United States wrote: "Tenure problems are one of the major 'stumbling blocks' to the adoption of conservation practices in the Corn Belt . . . Many farms in the Corn Belt are owned by absentee landlords who have little personal contact with their tenants. These owners do not realise that conservation adjustments will improve farm income over a period of several years. Instead, they want a high return on their investment now. On many farms the tenant is also interested in short-run profits. He may have only a one-year lease with no assurance of renewal, or the leasing agreement may require him to shoulder a larger share of the conservation costs than he receives in benefits."⁹ The statement stands in 1975.

An extreme case where tenure arrangements have induced myopic land treatment is Iran, particularly before the country's land reform programme was initiated in 1962. Fully 62 per cent of the country's farmers then rented their cropland, and it was common practice for landlords to shift tenants about each year from one field to another.¹⁰ Under these conditions, tenants could hardly be expected to invest their energies in land improvements that would pay dividends only over the longer term.

The conflict between present and future needs can also have international ramifications. For example, many soil conservation officials in the United States winced in early 1974 when national agricultural and economic planners, confronting dwindling grain reserve stocks, soaring prices and a strong export

market, called for "fence-to-fence planting." More than one old hand who had spent long, patient years coaxing Great Plains farmers to stop the cultivation of marginal areas found farmers again ploughing up pasture lands in response to record wheat prices and the national leadership's appeal. Of course, economists charged with fighting inflation, as well as humanitarians supporting an expanded international food-relief effort, were happy to see every possible bushel of wheat produced. Yet, should wheat remain scarce for a prolonged period and over-cultivation of the Great

It is naive to assume that the political act of distributing land and other social benefits guarantees ecologically sound developments . . . even where the legal structures and demographic and geographical conditions exist for sustainable land exploitation an *ethic* of conservation is its ultimate guarantee.

Plains again become chronic, the next extended drought will vividly document the self-defeating nature of this "solution" to grain scarcity.

These "priority" obstacles to sound land-use policies are in part problems of analysis and communications. Those best suited to do so have seldom tried to translate perceived ecological trends into the real cost accruing to society. While every government is busily adding up the hectares of new farmlands it has helped to bring into production, almost no one in any country is calculating the annual area *lost* to production due to erosion, salinization or urbanization — and even fewer are totalling the ultimate social costs in lost output and compensatory new investments re-

quired to offset eroded or salted lands. The quantification of ecological losses and potential gains from recovery efforts is usually extremely difficult, but creative thinking in this area will be essential if decision-makers are to be convinced of the urgent need for shifts in priorities.

Even more crucial than the analytical failure has been the communications failure. Those who know the ecological score too frequently feel their job is done when a report is filed in a professional journal that is accessible, in terms of language as well as distribution, mainly to other scholars. Those who most need to know about impending ecological disasters and then act on their knowledge — particularly politicians, civil servants, journalists and farmers — are frequently almost totally ignorant of what is happening. Establishing the urgency of a critical problem not traditionally recognized as such requires the constant broadcast of the facts and their implications to as many people as possible, through all possible means.

More effective analysis and communication of ecological problems may be a prerequisite of countering one of the greatest obstacles to a change in governmental priorities — the short time frame in which political leaders tend to operate. Ecologically sound planning requires concern for the next decade, the next generation and beyond; only the strong and vocal support — or insistence — of an informed citizenry can allow — or force — leaders to depart from their usual fixation on the next month or year. A widespread public understanding of the ecological danger is ultimately the prime weapon for fighting any commercial interests — whether highly placed timber concessionaires in Indonesia or Pakistan or corporate farmers in Central America — threatened by environmental protection measures. If powerful economic and political interests oppose necessary reforms, then a stronger political force is necessary to over-ride them, and information about the nature of the threats to well-being is essential for building such a coalition. This is broadly true of virtually all political systems — not just democracies.

If saving the land pits the present

against the future, in many ways it also pits the individual against society. Soil washed from the fields is a loss to the individual farmer, but may cause even greater losses downstream as canals or reservoirs are choked with sediment. Yet those responsible for the damage are not required to pay the costs. The acquisition of more cattle on desert fringes may increase the wealth of the individual family or clan, and may even increase their personal chances of surviving a drought. But it may make ultimate disaster more likely for everyone. Moreover, any unnecessary harm to the quality of the land undermines the national heritage, whether or not the individual or corporate user views the land in a long-term perspective. In 1974, a group of leading American scientists described one way the clash between private and social interests is manifested in the United States: "The pressure of financial obligations encourages farming practices that result in excessive erosion. Farmers usually do not experience noticeable yield decreases because they have increased the use of technology which more than offsets the loss of production from excessive erosion. Land owners and farm operators thus tend to ignore long-term disinvestment damage to their land as well as off-site damages which may not affect them directly but which result in costs to the public."¹¹

Once the changes in individual behaviour necessary for the general welfare are identified — whether a reduction in herd sizes, a limit on fish catches, or the construction of terraces — the next hurdle is to secure compliance. While every situation has its unique complexities, a few general observations on this, perhaps the most intractable of all challenges to the environment, are worth repeating.

Experience has proven that sound treatment of the land cannot be decreed by officials — particularly those viewed as alien or oppressive — and then forced upon people who do not understand why changes in their habits are necessary. Faced with serious soil erosion in their African colonies, the British in the 1940s and 1950s tried the coercive approach, and by any account the

ultimate results were abysmal. In parts of East Africa, Eastern Nigeria and elsewhere, colonial officials legislated changes in farming techniques and prohibited cultivation altogether in some watershed areas. Wise as the required measures may have been, the general response on the part of Africans was either resentment or apathy. A 1943 District Commissioners' report in Kenya suggests the curious and untenable position in which the alien rulers found themselves: "... most of the people have no apparent intention of saving themselves and their descendants, and are indeed continually breaking new steeply sloped land as soon as one's back is turned."¹² Soil damage was temporarily arrested where the British overseers could directly impose their will, but soil conservation became identified with oppression, and, as African countries gained independence in the early 1960s, many of the anti-erosion programmes were dropped.

In the United States, an elaborate voluntary programme was established when the need for special attention to soil conservation was recognized. Thirteen thousand soil conservation officials in every corner of the nation offer advice to farmers on conservation needs and techniques and, in some areas, provide financial assistance for land improvements. While erosion remains an acute national problem, few dispute that the Soil Conservation Service has helped slow the accelerating land deterioration of the early part of this century — and without coercive measures. But if a voluntary programme can have moderate success in the world's richest nation, where massive efforts can be financed, farmers are highly educated and the cultural gaps between officials and farmers are generally slight, what conclusions might one draw for the poorest countries where just the opposite conditions prevail? The dilemma is that, where voluntary programmes are least likely to be adequate, legislative fiats are least likely to change individual behaviour. Throughout the poor countries there is already a gaping abyss between conservation laws and their enforcement. This reflects not only poor communications between

governments and the rural poor, but also the clash between the exigencies of conservation and the individual's pressing, undeniable needs.

People hungry for land are not apt to leave forest or pasture lands unploughed, regardless of what ecological soundness dictates. Farmers hungry for bread are not likely to defer production this year to enhance soil quality for the next generation. Those with no other means than wood to cook their dinner cannot be expected to leave nearby trees unmolested even if they are labeled "reserved" by the government. And people brutalized by exploitive economic and social systems will probably not treat the land any more gently and respectfully than they are treated themselves.

Unfortunately, there are no quick fixes to the dismal cycles of poverty, ecological decay and rapid population growth. To be sure, conservation ethics and problems need to be treated daily as "news" by the media and as part of basic curriculum in educational systems. Regulations protecting essential forests and mountain slopes also need to be strictly enforced. But these measures will never succeed until the populace has the technical and financial means to co-operate, and this means reaching the masses with ecologically sound agricultural advice and with credit facilities, maximizing rural employment on farms and in small-scale industries, and breaking down the social, legal and economic structures that deny the poor basic opportunities for advancement. It means creating participatory institutions, whether through local government, co-operatives or communes, that give the poor a sense of responsibility for and control over their destiny. That these prerequisites of ecological recovery are identical to the tactics of a more general war against poverty and hunger should come as no surprise.

Among a large share of the world's poor, words like "conservation" and "environmental protection," if they are known at all, strike a negative note. They are associated with denial and repression rather than with the improved quality of life that those who use them have in mind. Clearly, the movement to

save an habitable environment will never succeed if its historical emphasis on protection and preservation is not balanced with progress in production and the satisfaction of basic human needs. Forestry departments will never effectively police forest reserves if they do not more successfully increase tree planting and wood production for local uses in forests, plantations and the countryside. Soil conservation agencies will not stop the spread of cultivation to steep slopes if agricultural policies do not also increase production and employment on the better farm lands and improve the distribution of land ownership and production gains. The wildlife refuges and undisturbed natural ecosystems necessary in the interests of biological diversity, scientific study and aesthetics will never last if social conditions and productivity in adjacent areas are desperately low.

Conservation means protecting trees from the axe where necessary or desirable, but it also means far more — for the principal aspiration of the world's poorest half is to climb from the depths of severe social deprivation, not to save the environment for its own sake. Those concerned with global ecological deterioration and its consequences have no choice but to throw themselves into the maelstrom that is the politics of social change.

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Traditional Cooling Systems in the Third World

by
**Allan Cain,
Farroukh Afshar,
John Norton
&
Mohammad-Reza Daraie**

Today more than ever the technology of the industrialised world is being exported intact to the developing world. Western industries depend on marketing their wares to the Third World in order to buoy up their own countries' failing economies. For example, in Britain now 50 per cent of the building industry is dependent on foreign contacts.¹ The West's technological development was founded on the cheap raw materials and energies taken from the colonial world. Developing countries today do not have a world of resources to freely exploit and a few are now beginning, out of necessity, to look towards a more self-reliant road to development.

Agricultural technology in the United States now demands 5 calories of energy input to produce 1 calorie of food; on the other hand, in China 1 calorie input of energy produces 20 calories of food — 100 times less.²

There exist in the Third World a wealth of indigenous technologies which have largely been ignored, if not actually suppressed, during the era of rapid growth in the industrialised world. However large numbers of people in the rural areas and old quarters of cities and towns in the Third World rely entirely upon indigenous technologies. These technologies are almost always identified as signs of underdevelopment because they are most often employed by the poorer classes of society. Those who have never had access to large amounts of expensive energy have invented technologies

which are efficient in use of local materials.

Millions of pounds are spent on the research and development of 'Advanced Technologies' — advancing them further and further away from any relevance to the majorities of the world. We believe that we must research and develop those "simpler" and not unadvanced technologies which the majority of the people in the Third World use and live within. Such a scientific reassessment of the indigenous in Third World countries could form the basis of a real development.

This article deals particularly with the indigenous technologies of cooling, using largely natural sources of energy and techniques which have been developed by people locally.

Maziara Cooling Jars

The Maziara is a traditional water cooling and purification system used in rural areas of Upper Egypt. The evaporative cooling properties of large porous ceramic water storage pots are employed. Similar methods have been used in different parts of the world to keep liquids and perishable food cool.

The supply of safe drinking water is a primary factor in the maintenance of public health in developing countries. Consideration must be given not only to the water source and its quality but also to the distribution and storage systems. In an Egyptian village area studied by the authors,³ there was no modern system of piped water to individual homes. Water was available from

wells or from the Nile River and its canals. Nile water and water from irrigation channels is unfit for drinking and often carries dangerous pathogens such as 'bilharzia larvae'. Shallow wells are also often polluted and clean water is only guaranteed from deep wells. Women collect water from these sources in the early morning and then carry water jars (bellas) on their heads back to their homes. Once home the water is stored in the Maziara. These large, unglazed ceramic jars hold the day's supply of water for drinking and domestic use.

The porous nature of the unglazed ceramic means that water seeps through the jar's wall, maintaining a wet outside surface. Some of the water evaporates and the rest drips down the sides of the jar and is sometimes collected. Drinking water is usually scooped out of the pot with a dipper, though it was discovered that water collected at the base after it had been filtered through the pot is much cleaner. The water in the Maziara is kept cool all day by the action of evaporation from the jar's outer surface. Evaporation, or the change of water from a liquid to a vapour, absorbs a considerable amount of heat energy (580 calories of energy for every cc. of water evaporated.) Heat is therefore continually drawn out of the water in the storage jars. The dry Egyptian climate means that the outside air can absorb a great deal of water vapour, and in turn a considerable amount of evaporative cooling can take place. The Maziara is usually situated so that

it is in a draft, for air movement aids evaporative cooling.

An experiment was set up using portable meteorological testing equipment in order to evaluate the cooling action of the Maziara (Fig. 1) Water samples were taken at various stages in the system, to be measured later in the laboratory for purity.

Results of the climatic tests showed that even though the outside air temperature ranged from 19°C. to 36°C. over the day, the temperature of the Maziara water remained relatively constant at 20°C. Since one feels comfortable in Egypt only between the narrow range of 21°C. to 26°C. the water feels refreshingly cool all day. The constant Maziara temperature (Fig. 2) may seem surprising with such a large air temperature range, i.e. 17°C. This can be explained by the fact that as the day progresses and the air temperature rises, the relative humidity (the amount of water vapour in the air) decreases (Fig. 3). As the air becomes drier more water evaporates from the water jar's surface and the cooling rate increases (Fig. 4).

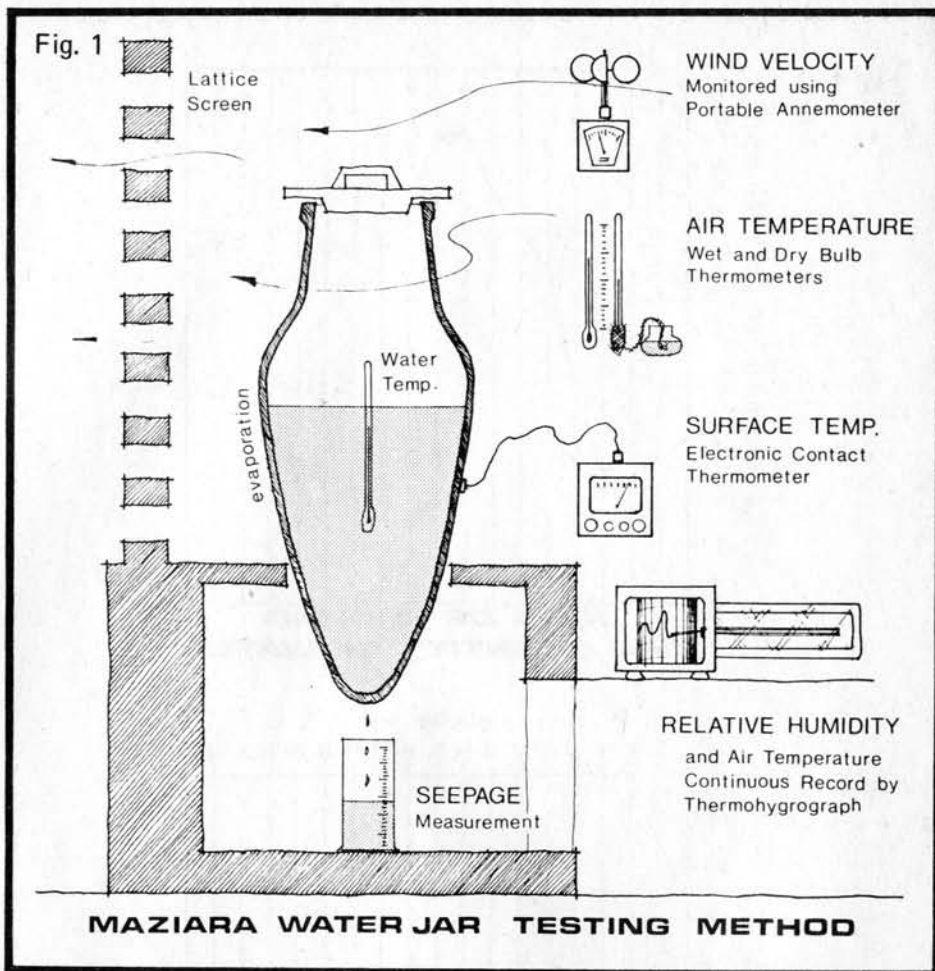


Fig. 2

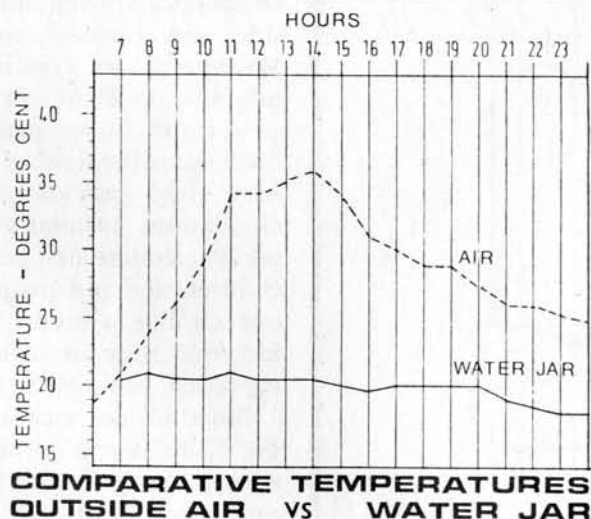
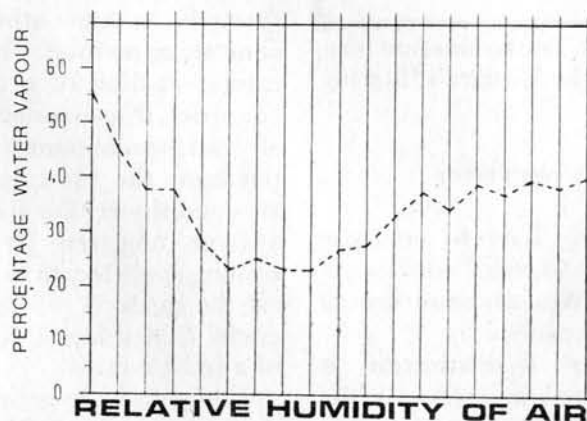


Fig. 3



The Maziara though mechanically simple proves to be a very sophisticated system; its temperature self-regulation is a response to local climatic changes.

Over a 16 hour test period a single jar produced 1700 k. cal. of cooling. At the hottest time of the day the jar's cooling rate was 165 k. cal./hr. or about 192 watts (Fig. 5).

In order to test the Maziara's water purification action a series of laboratory tests were made on water samples. Into the Maziara was placed water collected from the nearby Nile River. Samples were taken from the river source and from the effluent runoff after water had been allowed to filter through the Maziara system. Other samples were taken from inside the jar. Samples were tested in the Government laboratories in the Luxor hospital and it was found that the filtered outflow water was pure to the Government's drinking water standards, even though the original Nile water that was put into the jar was contaminated.

Pollutants can either be suspended in the water or chemicals dissolved in the water. The filtering action of

Fig. 4

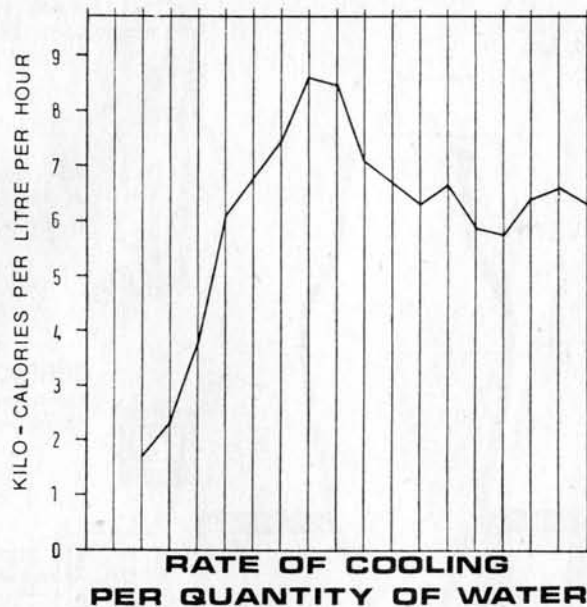
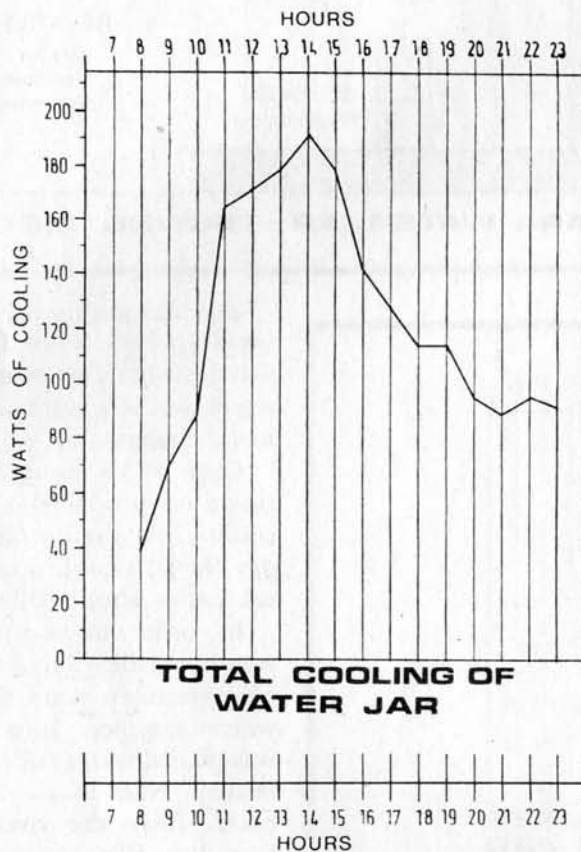


Fig. 5



the Maziara removed some of the suspended pollutants, but filtering alone cannot remove harmful chemicals or all microscopic organisms. It is therefore assumed that there were no such elements in the original samples taken. If the cleaning action of the jars is to be maintained they would have to be rinsed periodically and sterilised with boiling water.

The result of the purification tests illustrates that chances of

drinking water contamination can be reduced if the Maziara's filtering action is used.

Western Technology versus the Indigenous

It is interesting now to compare the indigenous Maziara cooling jar method to its Western counterpart, the mechanical cooler.

Technological sophistication is usually measured in terms of the number of transistors or moving

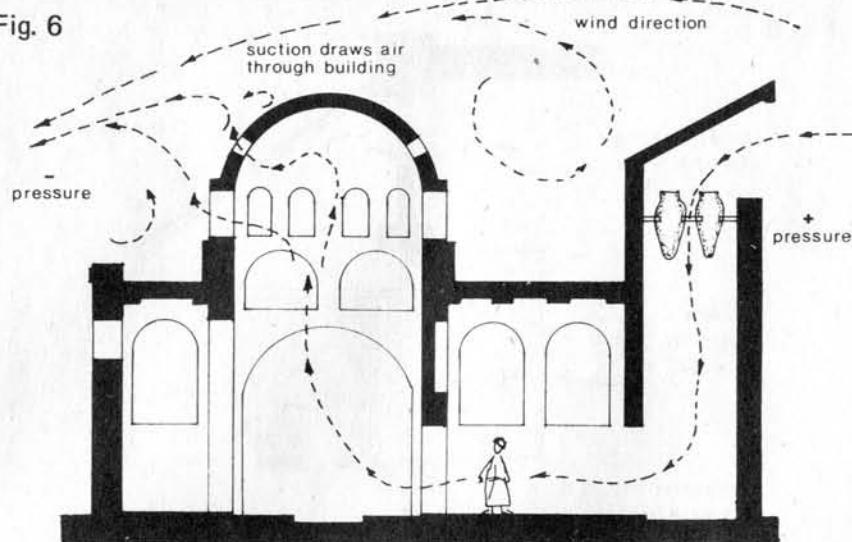
parts. On this count the mechanical air conditioner could be called a piece of advanced equipment. If we evaluate sophistication in terms of efficiency we find the opposite. An air conditioner producing 12,000 BTU's of cooling will in turn consume 2400 watts of electrical energy.⁴ This means that an equivalent of about 70 per cent of the total cooling output is required in electrical energy to run the unit. The Maziara cooling jar method, on the other hand, requires no other energy than that required to fill the jar with water in the morning. It is, as well, totally self regulatory and responsive to climatic changes without the aid of a complicated thermostat. The inefficiency of these mechanical systems is compounded and in global terms: "200 million Americans use more electricity for air conditioning than 800 million Chinese use for everything."⁵

The hazards of modern air conditioning systems are rarely advertised in the glossy brochures distributed by companies' dealers in the Third World. Mild shock sometimes occurs at the entry of an excessively cooled building, if the temperature differences between inside and outside are too great. Mechanical air conditioners often produce pools of very dense cold air in the lower parts of rooms. Such stratification of temperature over long periods affects blood circulation, respiration and other bodily functions particularly in children and old people.⁶ Indigenous cooling systems by the very fact that they are usually naturally regulated, avoid these dangers.

Most of the vast rural areas of the Third World do not have access to electricity in order to power a mechanical unit, and must therefore rely on some other non-energy consuming method. The average per capital income of people in many countries, if accumulated over several years, would hardly be enough to purchase the cheapest mechanical air conditioner. On the other hand, a large unglazed jar suitable for cooling, costs less than a pound, and can be made in a village kiln, and could if developed form the basis of a small industry.

Comparative experiments are currently being planned by the authors

Fig. 6



WIND-CATCHER WITH COOLING JARS

Air is cooled as it passes over evaporative cooling jars

in Iran, in the use of water jars for air cooling within buildings as against mechanical cooling. In theoretical terms, five or six water jars, each producing up to 200 watts of cooling, would be equivalent to a small window-mounted mechanical cooling unit of 1000 to 1200 watts.

Development of Local Technologies

A wide variety of cooling solutions based on the principles illustrated above have been developed indigenously in Third World countries, and there is still much scope for their improvement and wider use. Porous water jugs and even simple dampened reed matting have been used in conjunction with wind catching towers, which funnel air down into rooms of houses after it has been conditioned by evaporatively cooled surfaces (Fig. 6). Professor Hassan Fathy, in a design for a wind catcher for a school in Upper Egypt, used beds of wet charcoal for air to pass over before entering rooms, and he reports a drop of

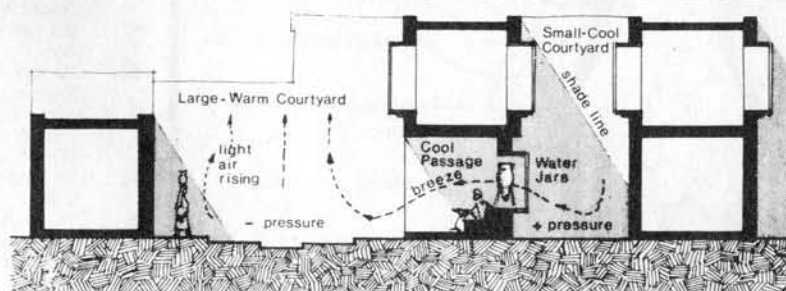
10°C. in air temperature.⁷ In Iran, wind shafts often lead to basement water cisterns. Both the air and water is cooled by the effects of evaporation. The water being stored underground retains its coolness, and the air after being cooled is directed up into the rooms of the house. (More information on the wind catcher as an air cooling device can be found in *Architectural Design Magazine*, April 1975, pp 217-218, by the authors.)

The courtyard of the Middle Eastern or Mediterranean house has long been known for its cooling properties.⁸ The court acts as a well to trap cool night-time air and retain it throughout most of the day. An interesting adaptation of the typical case is the two courtyard house. One court is small and deep and therefore generally shaded and cool; the other is wide and open to the heating of the sun's radiation. Air in the small courtyard, being cool and dense, has a higher pressure than the warm air of the large

courtyard, which tends to be lighter and therefore rises. If an opening or passageway connecting the two courtyards is well positioned, there will be air movement induced by convection from the cool courtyard through the passage to the warm courtyard. The air's velocity is controlled by the size and nature of the passageway as well as the temperature and pressure differences between the two courtyards. Water cooling storage jars if placed in this passage will add to the cooling effect of the breeze (Fig. 7). In houses where this feature is employed, the inhabitants spend the hottest hours of the summer days in this cooled space between the courtyards.

In Muscat Oman, water jars have been mounted in specially designed window openings, not only for the provision of cooled water but to reduce the temperatures of the air passing over them and entering the room (Fig. 8). Similarly in India simple coarse woven mats over window openings when wetted cool the air passing over them into the room. Such matting usually needs rewetting by hand every 20 minutes. A recent development in India based on research into the indigenous method is an air conditioning unit (Fig. 9) using matting of khus-khus grass, which is widely available in Northern India and gives off a pleasant aroma when wet, in conjunction with a water reservoir and a small mechanical fan. The water reservoir maintains a controlled drip which is just enough to keep the matting wet. A low voltage fan, which could even be battery powered, is the only energy consuming part of the unit.⁹ A development upon this could use a roof-mounted wind trap to provide air

Fig. 7



TWO COURTYARD HOUSE - AIR MOVEMENT INDUCED

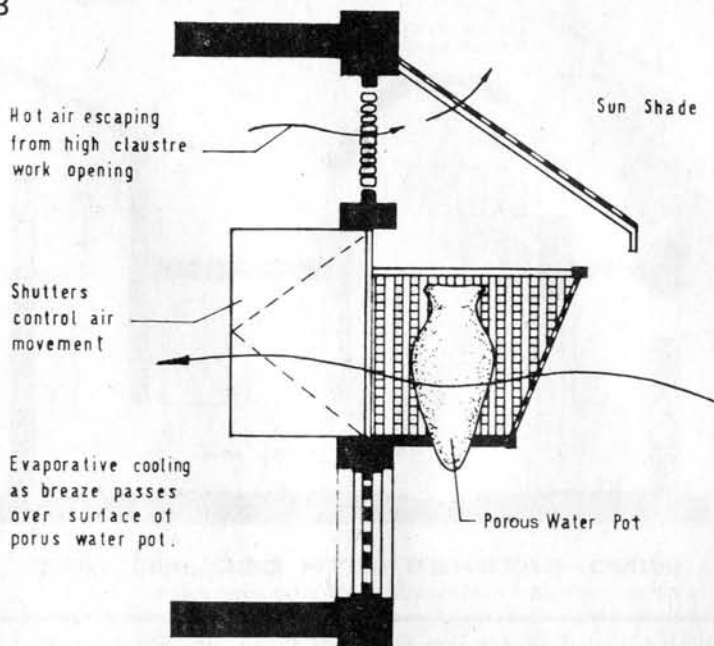
Convection system between courtyards. Breeze is drawn across cooling jars

movement and the fan as only a back-up system.

Perhaps more important than air cooling is the cooling and storage of perishable foods. A large percentage of the total food produced in Third World Countries rots and is lost before it is eaten because of the lack of any cooling storage facilities. Again in India evaporative coolers have been used indigenously which could help alleviate this problem. A domestic cooler was developed using a porous outer water jar and a glazed inner jar as a dry compartment to hold the food (fig.10). The space between the two jars acts as a reservoir for water, which keeps the exterior porous jar wet. Evaporation of water from the surface of the outer jar keeps the whole system, including food stored within it, cool.

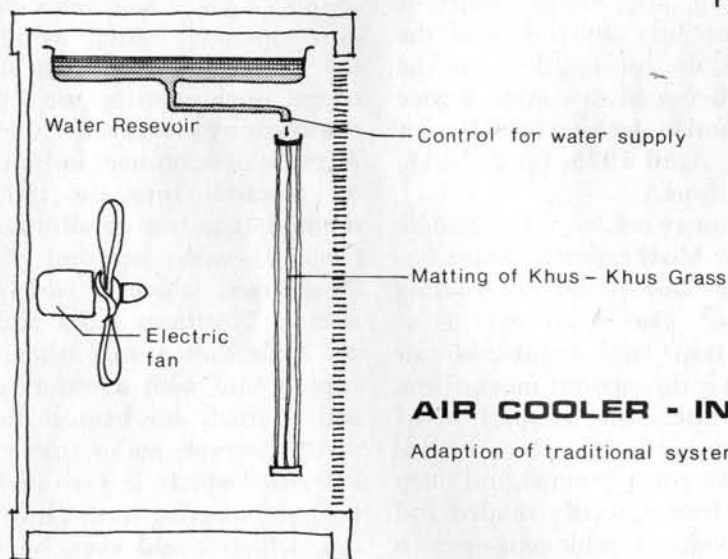
This article has dealt with some of the technological innovations that

Fig. 8



WINDOW MOUNTED COOLING UNIT - MUSCAT

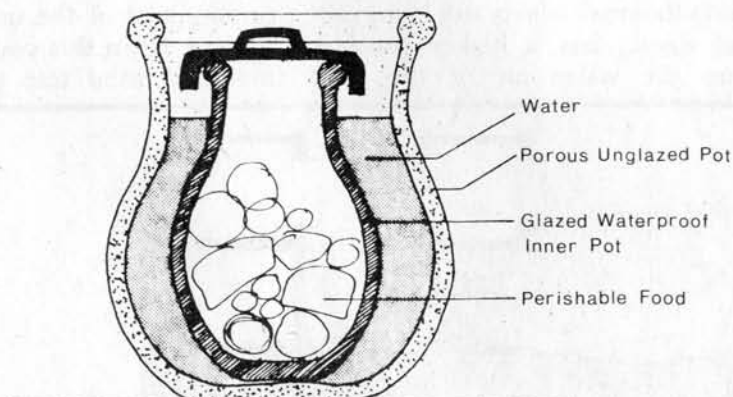
Fig. 9



AIR COOLER - INDIA

Adaption of traditional system

Fig. 10



FOOD STORAGE COOLING UNIT - INDIA

Evaporative cooling from moist exterior surface

have grown out of an indigenous scientific approach to a basic problem — cooling — in many Third World countries. It should be seen as one example out of many such neglected systems which could be developed upon. Technologies adopted, as well as the approach taken to the improvement of indigenous methods of solving problems have a strong impact upon the direction of the road any society chooses towards development.

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Note:
All photos, drawings and charts by the Development Workshop.

Notebook

Neither National Nor Parks

The National Parks of England and Wales would be more accurately described as "so-called national parks". The UN List of National Parks and Equivalent Reserves excludes them, as being neither national, since they consist largely of privately-owned land, nor parks, since the public have only limited rights of access, and agriculture and other industries are carried on freely in them. Doubtless, in a crowded, long-settled country like ours some compromise is necessary: parks like the Yellowstone or the Serengeti cannot be created in a country which has not so much as an acre of genuinely unspoilt and natural landscape. But when allowance has been made for British conditions, it remains true that Government policy on the national parks, ever since their inception, has been half-hearted and self-contradictory.

The Government's response to the 1974 Sandford Report on national parks was published in January; and while it was a step in the right direction, it was definitely no more than a step. It took the form of a Department of the Environment circular to local authorities, which managed to come down firmly on both sides of pretty well every fence in sight. The original policy on national parks had two chief aims — to preserve and enhance their natural beauty, and to promote their enjoyment by the public. But it has been becoming increasingly obvious that the second aim is frequently incompatible with the first. The Sandford Report advised that where such conflicts occurred, statutory force should be given to the objective of conservation as against enjoyment. The Department, while conceding the principle "in the last resort and in some areas", seems desperately anxious to have it both ways: "On the central issue of conservation versus public enjoyment the committee have concluded that both must continue to be given due importance, and that the main emphasis must not be on negative restriction but on positive management policies designed where possible to reconcile conflicts".

In a few instances the Department has brought itself to make positive and beneficial changes: for example, in giving the park authorities complete control over the siting and design of farm buildings. But, by way of contrast, how does it react to the question of road development — surely a far worse threat to the parks than the occasional concrete silo or Dutch barn? "No new route for long-distance traffic should be constructed through a national park . . . unless it has been demonstrated that there is a compelling need". (Presumably, up till now, they've been strewing the countryside with roads that *nobody* thought were needed.)

One of the most radical proposals of the Sandford Committee was for the setting up of national heritage

areas — central hard cores in some of the parks which would be *absolutely* inviolable, free from any compromise with the needs of industry, transport, defence, recreation or what you will. This proposal the Department of the Environment rejects. The rejection seems almost symbolic. Our national parks are faced with so many dangers: mineral workings, reservoirs, defence installations, pylons, motorways, caravan sites, television masts — you name it, someone wants to put it in a national park. And in every case there will be plausible and persuasive arguments why this particular violation is "in the national interest". If the parks are to survive in any form worth having, it is necessary that someone with the power to do so should be able to put his foot down and say no, firmly and finally, to any development not directly furthering the primary purpose of a national park. But it seems we must wait a while yet before such a saviour arises in the Department of the Environment.

A Question of Scale

"There is a limit to the size of states, just as there is to other things, plants, animals or implements; for none of these retain their natural power when they are too large or too small, but they either wholly change their nature, or are spoiled . . . In the same way a state, when composed of too few people, is not self-sufficient, as a state ought to be; when of too many . . . it is a race rather than a state, and is almost incapable of constitutional government." Aristotle, *Politics*.

Dead Controls

Does the Government really give a damn about endangered species? On December 15th the Department of the Environment announced its controls on imports of rare animals, plants and their products. These controls fail to implement the Convention on International Trade in Endangered Species of Flora and Fauna.

The controls as announced are an oddly half-hearted collection. For example, they allow the importation of made-up reptile goods (e.g. crocodile skin handbags), but not raw reptile skins; raw ivory and elephant skulls are banned, but ivory products and elephant skins may still be imported; unworked tortoiseshell is prohibited, tortoiseshell goods are permitted. It is hard to see what difference "controls" of this kind will make to the crocodiles, elephants and turtles, who will be equally dead whether they are imported raw or processed. One can only hope that the new ruling will be rapidly superseded by Lord Wynne-Jones's far more comprehensive Endangered Species Bill, which recently began its progress through Parliament.

A Building a Day

1975 was European Architectural Heritage Year. Britain's contribution included the demolition of about 350 buildings listed as being of special architectural or historic importance. However, reports that a forthcoming Artistic Heritage Year will be similarly celebrated, with a bonfire in Trafalgar Square of Raphaels, Rembrandts and Constables from the National Gallery, may be dismissed as irresponsible conservationist propaganda.

Wetlands in Danger

After buildings, wetlands. 1976 is European Wetlands Year — the term includes all types of marshes, bogs, saltings, mudflats and water meadows. In Britain, as elsewhere in Europe, these areas are among the richest habitats for wild life. But wetlands are very vulnerable to damage by many forms of industrial activity, and in particular perhaps by industrialized agriculture.

When drained, areas of this kind often form highly productive arable land: the Fens, largely reclaimed in the 17th century, have ever since then been one of the richest farming areas in Britain. Now the Ministry of Agriculture is actively encouraging farmers to embark on ambitious drainage schemes to eliminate our few remaining vestiges of fresh water wetland: and many tidal estuaries, for example those of the Tees and the Humber, are also under threat from land-hungry industries.

One area currently under attack is the Monmouthshire Levels, a vast stretch of low-lying pasture around Cardiff and Newport. The Levels are criss-crossed by a 750-mile network of ditches known as "reens", which are the habitat of a number of rare plants and animals. Delegates to the British Ecological Society's annual conference last month were warned of threats to the Levels. Modern agriculture is gradually doing away with the reens, which are being replaced by drainage pumps. Since the completion of a sea wall in 1972, the area is free from flooding, and consequently ripe for development: plans are afoot to resettle people from the industrial valleys along the coastal belt; and South Glamorgan County Council has applied for a compulsory purchase order for 1100 acres of the Levels for an industrial estate. European *what* Year?

Science Marches On

A "death-ray" weapon of the sort familiar to science-fiction addicts may soon be a reality, writes R. T. Pretty in the foreword of *Janes Weapons Systems 1976*. Lasers, extremely powerful and concentrated beams of light (of the sort which threatened Sean Connery with a fate worse than death in one of the James Bond films), are already being used to help bombs, rockets and shells to find their targets. Now, says Mr. Pretty, "beneath the guarded references to high-energy laser research and development in American Department of Defence publications, and behind the virtual Soviet silence on the subject, it is probable that these two powers are locked in a costly super-scientific struggle to be first with a practical laser

weapon capable of destroying a military target . . . solely by means of the energy the laser is able to generate and transmit to the target". No doubt when it comes we will be assured that it makes war unthinkable: which, as everyone knows, is what they also said about the crossbow.

The New Inquisition

One of the more diverting episodes during the United States inquiry over Concorde was the spectacle of a former Tory minister (Lord Boyd-Carpenter) and a present Labour minister (Gerald Kaufman) united in frantic condemnation of Hugh Montefiore, the Bishop of Kingston. The Bishop had had the temerity to go to America, on behalf of the Heathrow Association for the control of Aircraft Noise, to give evidence on the intolerable noise burden that Concorde represents. The Bishop is president of this Association, a body which has been unable to present its views at a public inquiry in this country, since no such inquiry into Concorde has ever been allowed to take place.

The Bishop's statement was largely factual, and supported by written evidence. But Lord Boyd-Carpenter (chairman of the Civil Aviation Authority) and Mr. Kaufman (Minister of State at the Department of Industry) reacted like two members of the Inquisition suddenly confronted with a new and particularly shocking heresy. Mr. Kaufman resorted to vulgar

This Month's Authors

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Erik Eckholm is a researcher with the Worldwatch Institute in Washington, D.C. and author of *Losing Ground, Environmental Stress and World Food Prospects*. (Norton and Co. N.Y. 1976 and Co-Author with Lester R. Brown of *By Bread Alone* (Praeger N.Y. 1974)

Alan Cain, Farroukh Afshar, John Norton and Mohammad Daraie are members of The Development Workshop, a group of architects and researchers from various countries who are carrying out research and development work on indigenous buildings in Third World countries.

Nicholas Gould is a freelance writer known to readers of *The Ecologist* for many contributions. He has undertaken to write our revived *Notebook*.

abuse — “froth and emotion”, “a Monty Python sermon”, “a music-hall turn”. Lord Boyd-Carpenter, all virtue and sweet reason, took it upon himself to recall the Bishop to his pastoral duties — “Surely in his diocese there is work to be done which could fully engage even his bounding energy? Is there not religious apathy to be fought, lax morality to be countered? . . . Would it not have been more useful, not to say more appropriate, if he had devoted his time to spiritual matters?” Such calls to churchmen to leave public affairs to the professionals and stick to the spiritual side of the business are of course nothing new. Thomas Becket ran up against the same sort of thing. But it is odd that this religious zeal on the part of public men never seems to manifest itself when a churchman speaks out *in favour* of their policies.

How Much is Your Deodorant Worth?

The consensus of opinion among meteorologists seems to be that supersonic airliners are unlikely to present any *immediate* threat to the ozone layer in the atmosphere. In the near future, there will be too few of them, flying too low. But the World Meteorological Organisation has issued an urgent call for more research into the subject, so that all scientific doubt can be eliminated before numbers of Concorde and Tupolevs (the Soviet equivalent) rise into the hundreds. (Yes, of course you know and I know that even if it were proved beyond the remotest shadow of a doubt that Concorde was directly responsible for acne, wife-beating, earthquakes, inflation, senile decay and the Angolan civil war, Mr. Anthony Wedgwood Benn would still be calling it a “magnificent technological achievement”: but meteorologists are simple, innocent people who still have faith in the power of reason to guide human affairs.)

On the other hand, the W.M.O. scientists agreed that aerosol containers represent a real and serious threat to the ozone layer already. Even at 1972 rates of consumption the fluorocarbons used in these sprays would probably diminish the ozone by 10% in 50 years. The climatic effects of such a major alteration to the atmosphere are notoriously difficult to predict. Either a new Ice Age or a catastrophic rise in the level of the oceans is on the cards. Of course, we *could* be lucky: the dire predictions could prove groundless. But how much risk is it honestly worth taking for the minimal benefits of instant shaving foam and spray-on deodorants?

Britain's Unjust War

Take the most fiercely independent of Viking Norway's tribal chiefs and free peasants; add a dash of Irish and Scottish Gaelic blood; simmer for a thousand years on the bleakest and most remote of Europe's offshore islands. That, roughly, is the recipe for modern Iceland, and the end-product, predictably, is a people shrewd and tough and disinclined to be pushed around by anyone. This in itself would make Britain's recent “cod war” tactics imprudent: when a government makes a bid for popular support at home by getting tough with some conveniently small opponent overseas, it must be a

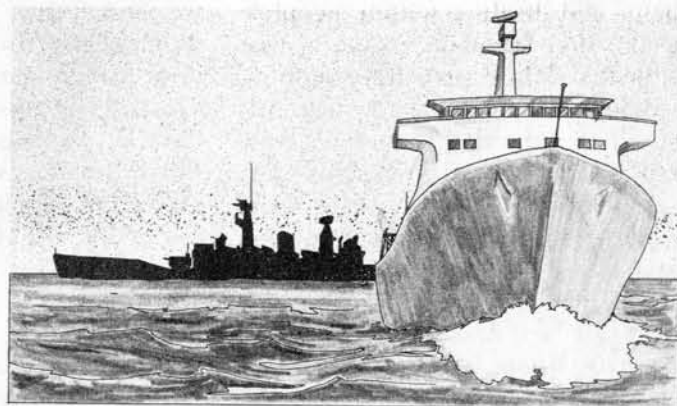
little disconcerting when the opponent refuses to lie down and be trodden on. But in this case Iceland holds so many of the cards that one can almost feel *sorry* for the British Government (an unfamiliar sensation for most of us).

In a strict legal sense, Britain is in the right, of course. But even that small shred of a just cause is unlikely to be valid much longer; for it is virtually certain that when the UN Conference on the Law of the Sea finally settles the details of an international agreement, *every* maritime nation will be allowed a 12-mile territorial limit, and a 200-mile economic zone with full control over fish and mineral stocks. To use an agricultural metaphor, the most productive one-third of the oceans of the world will cease to be a “common” and become “enclosed”, private property.

When that happens, it will be interesting to see which nations farm their new territory most far-sightedly. On present showing, the Icelanders are likely to do better than the British. For the cod war has really been about conservation: and the Icelanders, for whom cod is a necessity rather than an enjoyable extra, have already learnt, what Britain has still to learn, that fish stocks, like every other renewable resource, must not be used up faster than they are replaced.

In 1970 470,000 tons of Icelandic cod were landed; by 1975, 360,000 tons. Modern methods are catching increasing numbers of immature fish; and the fishing fleets of East Germany, Poland and Russia would probably have joined the spree had not the Icelanders extended their limit when they did. Now the Marine Research Institute of the Icelandic Ministry of Fisheries has announced its findings — to enable the cod population to recover the catch for 1976 needs to be reduced to 230,000 tons. Britain, whose 1975 share was 130,000 offered a reduction to 110,000, which would leave the Icelanders with a choice between watching the cod decline rapidly towards extinction, and halving their own catch (and cod represents about 40% of the foreign exchange income of a nation which really *must* export or die).

The Icelanders have already seen the herring fisheries of the north-east Atlantic literally destroyed by overfishing (from 8,500,000 tons in 1958 to virtually nothing in 1970). They are right to stand firm in their determination that the cod shall not go the same way.





Report

TRANSITION TO SARVODAYA

A report on the Conference held at Conway Hall London, in December, under the sponsorship of the London School of Nonviolence and *The Ecologist*.

While we were meeting on Sunday the 14th, readers of *The Observer* were learning from Dr. Mark Abrams, who is in charge of the Survey Unit of the Social Research Council, that 'A large majority of the British people believe that money can solve all their problems.' Dr. Abrams thinks that if things turn majority have no time for self-improvement and vote Labour because they believe it will deliver the material goods, not for any idealistic reason. The only group most people think should go up the social scale is the police. Dr. Abrams thinks that if things turn nasty, these nasty thoughts inside people's heads may lead to another Hitler. On the other hand *Social Trends*, the 270-page production of the Central Statistical Office, just published, shows, in the words of one of the departments senior assistants, that 'all the evidence points towards a healthy society'. On the surface, then, all is contentment and health: within people's heads are, though, some nasty thoughts. While they have money, people are content with their private lives, provided they don't compare themselves with nations that have even more money. It is that, says Dr. Abrams, that leads to dissatisfaction with the government. But if money should begin to lose its value so drastically that the majority begin to feel poor, then they will become violent. How can

it to be a healthy society if the idolatry of money and goods leads to violence?

The only conference to my knowledge that has squarely faced up to this situation in the world around us is the Sarvodaya Conference. The chief speakers addressed an open meeting at the Conway Hall on the Saturday. A good look at the full house convinced me that there were none of Dr. Abrams' majority there. They don't yet see any need for sarvodaya. As Dr. Abrams put it, 'People, though contented with their private lives, are profoundly dissatisfied with — and tending to cut themselves off from — society at large.' While pleasures are those that the individual can buy with money, the community disintegrates and people become dissatisfied with it. Thus, ironically, they vote for policies that lead to this dissatisfaction because they can't see the connection.

This conference was concerned with the connection. Every speaker related the satisfactions of the simpler life to an enriched community life and a materially poorer individual life, to self-improvement, to everything, in fact, that the public appears to disregard. The more money individuals demand, the more difficult it is to improve the community. They buy what they want instead of making what they need. Self-improvement through community life and action is the only way we shall create the non-violent society. But the contemporary community believes machines should produce goods en masse and consumers should be given the money to buy these goods. The problem for the conference was how to show people the destructiveness of this belief on every level and how to wean them from it. Fortunately we know that moods can change dramatically; but unless the mood does change nearer to that of sarvodaya there is good reason to suppose that Dr. Adams' fears will be fulfilled. Hence the importance of sarvodaya, though we should not underrate the difficulty of being decently poor while society is affluent. This is the transitional period.

Lanza del Vasto enthralled us all with his exposition of the self-

sufficient community run on sarvodaya lines. How absurd our machine/money civilisation seemed after that: how ludicrous the assumptions by which we live. Dr. Schumacher followed this with a brief historical account of how we had travelled to such a worship of mammon through the subordination of the unmeasurable and spiritual to the measurable and material. 'The slenderest knowledge of the higher things is more important than the exact knowledge of lower things,' he said.

After all this philosophy, what do we do? When it came to action, at least so many people thought, the only thing we could do was to go out and squat on somebody's land, cultivate it organically and learn how to spin our own clothes. 'We've heard all that before,' some despairing soul said, 'What can we do who live in the great conurbations? Tell us what we can do?' It was this that made a few of the audience go home. After all you are not damned if you happen to prefer a city to the land. Your problem is to humanise the city and understand its dependence on the land.

However, had the impatient souls listened to what was being said a little more attentively and applied it to their own self-improvement within any habitat, they would have learned a lot about how to create and sustain communities in town or country. Lanza del Vasto with his long white beard, home-spun clothes and noble features, like Noah addressing his family from the bridge of the ark, taught us many of the secrets of unconstraining leadership — 'voting is division, nobody must be squashed' — and of the folly of the hundred-thousand-year war against the 'wicked' which has justified legitimate violence — defence, justice, voting. 'Be a reconciler, spot a quarrel before it develops; when it breaks out it is too late.' We need this perfectionism — what patience is needed! — to keep the rest of us inspired. I remembered a sentence of Dostoevsky's in a speech on Pushkin, 'Elevate your spirits, young men, and formulate your ideals.'

Leopold Kohr disarmingly informed us that he had never under-

taken any action in his life and his father had compared him to Oblomov. This must have appealed to those who did not want to take their spades and squat on the land.

What does sarvodaya mean? I didn't know, except that I associated it with Gandhi and non-violence. But its meaning began to define itself in practical terms as the conference proceeded. We had now established some principles; we were formulating our ideals by uplifting our spirit. Lanza del Vasto had showed us what we could learn from the non-violent community about living in harmony, even if we were not self-sufficient country-folk. Dr. Schumacher had exposed the materialist assumptions of our economic-scientific culture. (Why are scientists always brilliant?) And Kohr had showed us the need to change the structure of the national community.

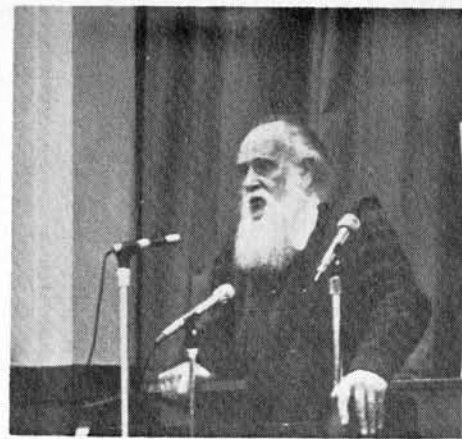
Although many eager persons shouted 'We want action, not philosophy' may I, as an old man with a beard, comment that action that is not soundly grounded in philosophy leads up a cul-de-sac as many activists of the past now ruefully acknowledge, as well so well described by Peter Cadogan in the Conservationists' Turning Point Conference in the same hall a fortnight earlier. It is not easy to persist to the end if you have not a self-correcting philosophy learned through experience and reflection. Yes, action is needed. (May I quote Dostoevsky again? 'Humble yourself, idle man, and go and toil in the fields.' But don't overlook the spiritual object of doing this.) Enthusiasm is essential but it is not enough.

The difficulty of formulating action became apparent in the groups that met on the Sunday for that purpose. Or was it really as difficult as we made it seem? Didn't the people who shouted for action perhaps want to be spoon fed? Wasn't it their business, once they had understood the philosophy in principle, to go home and apply that philosophy according to the most urgent local needs? Isn't that what decentralisation means? Is all the action to be directed from the centre? No, Satish Kumar made that plain when in his role as chairman he said that we were a

loose organisation of like-minded persons.

I was in the land group. This group pooled some interesting ideas led by Herbert Girardet who has understood that reform of land use must be associated with reform of the village which is the focus of rural life. But this reform is at the moment still in the philosophic stage. Do not despair because of that. All growth takes time and needs Lanza del Vasto's patience and Schumacher's T.L.C. — the tender loving care the farmer should feel for his land. Ideas treated with T.L.C. can become stronger than vested interests, as I have recently witnessed for myself, as established ideas about economic profit begin to crumble before the conservationists' persuasion. Spread sarvodaya ceaselessly, probably without mentioning the name. In the end, for good or ill, the miracle happens. But what about intermediate action in the transitional stage? Something like 80 per cent of the land of Britain, surprisingly enough, is still farm land. It is owned by a minute section of the population. As John Seymour said, one person may own thousands of acres — or one company. No one should be allowed to farm such large areas. It is now incontrovertible that the best yields come from smaller farms, quite apart from the inhumanity of large farms. Very well, as John Seymour advocated, why not squat on the land neglected by the giant farmer? If enough people demand the land, the law will have to be changed: it is the unfinished business of the French Revolution.

The Community Land Bill which has just become law offers determined groups the opportunity to persuade their District Councils to buy the land for smallholdings, allotments or co-operative farming development. Inspire them with the idea. While working away at that also advertise in the local press or put cards in shop windows asking for people who have gardens they cannot cultivate (or if old people are unable to) and offer to do it for them on a produce-sharing basis. This can be done in cities. There is plenty of wasteland in towns, often owned by nationalised industries. The Community Land Bill, if it is worked in the right spirit (and not



Lanza del Vasto speaking at the Conference

for financial speculation on the part of councils, has just that kind of idealism behind it. We must make use of it.

All members of our group agreed to report back in a year's time what they had done. I hope all the other groups did the same. To stop the building of a nuclear power station by occupying the site is an action we can all agree upon. But there are less spectacular actions which are important within the general pattern of humanising society. I myself am engaged upon trying to prevent the expansion of the airport at Norwich and an alliance of societies has been formed for that purpose. The land on which the airport is cited is badly needed by Norwich for enterprises of more value to the community. We have to inspire District Councils with a vision of something communitarian — houses, allotments, parks designed in one unity.

The greatest sin is to make people despair. The message of the conference for me was one of hope in the face of the blind optimism of the Central Statistical Office — full of brilliant scientists no doubt — and the more realistic fears of Dr. Abrams. We have to work on people's thoughts (including our own) so that breakdown is breakthrough and not calamity. Our materialist society is unhealthy however long it takes to crack up economically and ecologically. It must end in violence and conflict because people have not trained themselves to let go of possessions. We must show by example that we need not despair even when we are poorer than we once were. On the contrary . . . we shall find sarvodaya.

Robert Waller



Books

Morality and Agriculture

THE POLITICS OF FOOD. Daniel Green. Gordon Cremonesi. £5.00.

After a most impressive survey of the politics of food that includes most aspects of this complex subject, Mr. Green concludes that the future is unpredictable; that when so many experts disagree, no one can be dogmatic; that it is foolish to live as if doom were already determined, but equally foolish to live as if it were impossible. 'The wise man, contemplating the possibilities of disaster, will be neither unduly sceptical nor unduly credulous. He will listen to the voices of doom and remain calm. He will also, if he is very wise, cultivate his garden. He may have need of it.'

The Politics of Food has a plot which slowly unfolds — the relationship of productiveness to land-ownership. And you will observe that even in the last two sentences in the book it pops up again, though Mr. Green was probably only searching for a nice philosophical turn of phrase for an ending. What will the very wise man do? He will make sure he has a garden to grow food in. And what would a very wise government do? It would do its best to assure that everyone had the opportunity to own a small patch of land, for the whole nation may need the food produced on these small patches, as the Russians have needed the food grown by the peasants on their allotments. The nearer we approach the large farm as the norm — whether run by the state or agrobusiness — the more we shall need this safeguard.

Mr. Green makes a distinction between productivity and productiveness. Productiveness is a yield per acre and it is small farms that are the most productive; productivity is yield per man at the minimum cost and it is large farms that have the greater productivity. Thus productivity drives out productiveness and contributes to world starvation. It is productivity in which the British excel though they are certainly capable of great productiveness. It is the productiveness of the French peasantry that creates the EEC surpluses that so arouse the moral indignation of the British.

Food is grown on land; who owns the land affects the production of food; it also shapes social justice and moulds the personality of a large section of the nation. There is a great difference in the behaviour of the agricultural community and the urban industrial community in their attitude to work, profits, wages, strikes and the like which can be traced to this. The majority of farms are still small businesses, most of them owned by the family that works them. They provide almost the last stable productive element in our industrial society.

Our gathering and hunting ancestors did not own land, nor did they manage the productivity of the land. Tribes that lived off the fruits of the earth without either hunting or gathering appear to have been without jealousy, hatred or aggressiveness. Hunting and gathering tribes are the last societies whose members are socially equal.

Once the ownership of land had originated with farming — and it increased with the progress of farming as our own history of Enclosures illustrates — possession became associated with ostentation, power, enforced labour and the extortion of rent from those who needed land in order to exist and develop their occupations. The hated landlord had his heyday in 18th and 19th century Britain, the era of the rentier. However, on the continent of Europe, liberty became associated with the peasant owning his own land. The French Revolution was largely a peasant revolution that removed the French aristocracy

— who were courtiers not agriculturists — and established an egalitarian right to land as a safeguard of liberty. Mr. Green traces the effects of this on modern French agropolicy. Although the land reform was too egalitarian, in that it overfragmented the farm structure, it established the principle of land, liberty and equality. As the British have never had a yeoman's revolution, they do not share the feeling that liberty can be anchored to the family farm. This feeling is a bulwark against the nationalisation of land and the proletarianisation of the workers on the land such as has taken place in Russia. It explains why the French Communist Party supports the peasant and probably does not intend to betray him as the Soviets did.

Looking back over the history of agriculture we can discern how it has changed from being the source of slavery and serfdom to the source of liberty independence and initiative, provided that its structure is aimed at relating social justice to productiveness. We know that in Roman history the small farm encouraged liberty and initiative and the large farm introduced slavery and decadence. Thomas Jefferson hoped that America would stay a land of small family farms buying their industrial products from Europe — the opposite to the English ideal. It was this way he thought that liberty could be most securely established. Both policies were exaggerated: but it remains true that even the Americans still respect the family farmer more than we do. It is tempting to say that only in England and Russia is the farming community regarded as merely a means (which unfortunately can't be entirely dispensed with) of sustaining the industrial society. How much influence does the farming community have on a general election? The answer is none. It has to exert its influence behind the scenes through the NFU.

In his classic book *Man and the Land**, Erich Jacoby has demonstrated how the structure of land ownership determines both productiveness and social justice throughout the world. The first principle of mankind feeding itself is land

reform. Of course land reform implies a great many related revolutions that a reborn peasantry will need in order to become self-sustaining and provide national markets with sufficient produce.

When I had finished *The Politics of Food* I did not see how it was possible to avoid the same conclusion and that the two books are complementary. While Jacoby dealt mainly with the under-developed countries, Green treated the USSR, America and the EEC countries.

There cannot be a successful politics of food unless it is founded upon a policy of land ownership that establishes maximum and minimum sizes for farms according to the kind of husbandry and the quality of the land. Our government must understand that and oppose both the state ownership of land for the purpose of state farms and the ownership of land by business corporations. We must restore the farming ladder, now kicked from under the farmer's son and the farmworker by inflation and economies of scale. We should supplement this restoration of equality with a drive by local authorities to increase the number of allotments available; they should start garden colonies such as the Danes had during the war. The very wise men of all classes would then be able to practice their wisdom as Mr. Green advises. England after all only produces half her food and will produce a lot less than half from her present farm structure if oil, fertiliser and feeding stuffs become more expensive and scarcer: it is the small farmer and the allotment holder who thrive best under these conditions. The so-called large scale intensive farmer goes bankrupt.

Whether Mr. Green accepts the policy I have drawn up on his behalf or not I congratulate him on a first rate book which I am sure I shall consult many times in the future.

Robert Waller

* *Man and Land. The Fundamental Issue In Development*
Erich Jacoby with Charlotte Jacoby. Andre Deutsch 1971. £4.75.

Man Before The Fall

THE CHALLENGE OF THE PRIMITIVES by Robin Clarke and Geoffrey Hindley. Published by Jonathan Cape, 1975, £4.95.

That recalcitrant Jesuit, Teilhard de Chardin, imagined future man moving towards complete spiritual fusion with God — the Omega point — by establishing a common thought layer — the noosphere — around the surface of the globe. Through being locked into the noosphere, and unable to escape its pervading influence, the whole of humanity would unify its aspirations to the common good and would thereby attain unity with God.

Chardin was a fervent evolutionist, and the noosphere, like the biosphere which generated it, was for him, the next link forged in the long evolutionary process beginning with the origin of life and ending in complete communion with God. I for one am doubtful about Chardin's Omega point; the notion seems inextricably linked to the supposition that man is superior to the rest of creation and that his annexing of the planet for grandiose industrial schemes is all part of some inevitable evolutionary process. Chardin's philosophy is surely a *carte blanche* for technocratic progress. Yet, for all that, Chardin may have been right in supposing that a thought layer around the earth would bring man into harmonious relationship with his fellow men. In that respect it is fascinating how different people in different parts of the world, from wholly different backgrounds, have all tumbled to the same conclusion about the spiritual (if not economic bankruptcy of the industrial world and have begun searching desperately for alternatives.

Where do we look? One place is at Man before he fell, which simply means looking at "primitive man" and asking oneself the right questions about his way of life in relation to our own. Yet even though we may feel ourselves innately sympathetic to the "primitive" (dare I suggest the noosphere at work), none but a mere handful of us have the means or the sense of adventure to take ourselves off to

darkest Africa, to the Amazonian swamps, or even to the frozen Arctic wasteland, in order to seek out those few remaining primitives who have been pushed inexorably to the isolated limits of the earth. We need informing, and in their book *The Challenge of the Primitives*, Robin Clarke and Geoffrey Hindley have done just that, and very well too.

Modern industrial man likes to convince himself, or easier still, likes to be convinced by those who claim to know better, that in every aspect he has a better life than his forbears, particularly his hunting and gathering forbears of prehistory who after two million years of the same old life were obviously itching to progress towards what we have today (how else could they arrive here?). So, we've been led to believe that ours rather than theirs is the affluent society, and that we are the ones with better health, more leisure, better entertainment, greater freedom, a superior means of food production, and that we are more democratic and far less barbarous than they were.

By selecting excellent anthropological material Clarke and Hindley demolish every carefully nurtured myth to which industrial man clings in order to justify himself and his highly selfish existence. Primitive man is not the sick, beleaguered (except by us) aggressive, scrounging creature that many have imagined, to be missionized, like Darwin's captive from Tierra del Fuego, as hastily as possible, into accepting the "real meaning" of existence within the industrial world. Instead the primitive is a highly social, responsible being who has managed to curb his excesses — including overprocreation — in order that his own group's existence may flourish. Indeed as the two authors point out, we have much to learn from the primitive, especially with regard to human relations. No man is perfect and primitive man has his quarrels, bickerings, rivalries and even murderings. Yet their attitude to crime and to the transgressing of tribal relations is far more mature than ours. Laws for them are not a demonstration of a just, highly evolved society, they are rather indications of the breakdown of natural good behaviour within a tribe. As

far as possible the primitive attempts to prevent anti-social behaviour and inter-personal conflicts from becoming 'criminal' by mediation and persuasion, and the entire tribe participates in the problems of its members. Our own group therapy techniques are primitive by comparison because they generally take place outside society and are never an integral part of it. Under those terms they are hardly relevant to our day-to-day existence, whereas tribal participation in aberrant behaviour surely is.

The primitives have a natural sense of ecology — they really know their environment and perceive it in a way of which we are no longer capable. They live life to the full if given half a chance by us 'superior' beings. Hopefully it will not be too late to learn from them, either because we have wiped ourselves, or more likely them, out of existence, and if anyone wants to get an inkling of how they live I heartily recommend *The Challenge of the Primitives*.

Peter Bunyard

Arboreal History

HAYLEY WOOD: ITS HISTORY AND ECOLOGY by Oliver Rackham. Cambridgeshire and Isle of Ely Naturalists' Trust Ltd., and Cambridge University Press, 1975, £3.00.

We are deeply indebted to the Cambridge University scientist and scholar Oliver Rackham for his account of a thousand years of activity in Hayley Wood, West Cambridgeshire, U.K. This one hundred acre (0.40ha) wood, and others like it on the boulder clays of the locality, provided the communities there with fuel and construction material from Anglo-Saxon times until the Industrial Revolution, a period when self-sufficiency was the basis of village economy:

"In much of Eastern England, medieval woods are — no, were in 1945 — nearly as numerous as medieval churches. Woodland was until recently a cherished resource in this sparsely wooded region. Now that the world's economists are painfully debating the 'new' ideals

of renewable resources and sustained yields, we do well to remember that the objective of sustained yields was explicitly written into the management of Hayley Wood more than 600 years ago; the principle was not new then, and was faithfully maintained for the next half-millennium."

The manner in which these woods were organised consistently to provide for local needs occupies the first quarter of this important book. No trees were ever *planted* by our forefathers; that is the technique of the forester, known in England only over the last 300 years. Instead, shoots sprouting from the stumps of felled trees were allowed to grow to the required thickness and length. An annual cut of seven-year-old shoots (known as under-wood or small coppice) was usual in West Cambridgeshire to meet the greater part of the fuel requirements. This small coppice was also suitable for hurdles (moveable fencing) and wattling (woven framework within mud walls). Much less frequently, when a specific need arose, older coppice shoots and single-stemmed standard trees were selected and felled by the various craftsmen for constructing implements and timber frame buildings. Oak was favoured for building and was the principal large tree in the medieval wood; most of the native tree species were regularly coppiced. Analysis of building timbers by Oliver Rackham has shown that the trees selected were short, and young (25–80 years) by modern standards. The trunks were squared off with the adze and were not seasoned (sawing, and the use of planks only came to the fore in the 17th century). Great ingenuity was developed in using pieces that were slightly crooked.

Good management and workmanship were required to ensure the availability of the various wood products in the necessary quantities. This was provided by a woodward with two assistants working for the owner of the wood. The owner was generally the major landowner in the village, who often held estates in other villages as well. The woodward ensured the stockproof character of the great ditch, bank and fence that surrounded these medieval woods, for domestic animals and deer eat young coppice

shoots. Pig-grazing in woodland (pannage) seems only to have been practised in the early Middle Ages in Eastern England when the pressure to conserve wood stocks was rather less. Small coppice for fuel was granted to villagers in exchange for services to the owner, or was paid for with cash. Wastage was rare, as medieval accounts mention sales of loppings, ships, bark, rotten wood and even leaves. Certain villages without a wood obtained supplies from nearby ones with a surplus. With the constant drain of organic material from these woods it is interesting to note the lengthening of the coppice cycle over the centuries from seven, to fifteen years. Rackham postulates a gradual depletion of soil phosphorus as the likely cause.

Cheap coal in the 19th century ended the main need for underwood, and the requirement of coppice material for various craft purposes dwindled to nothing by 1950. At the same time timber became increasingly grown on its own in plantations, often on the site of former coppice. Old, overgrown coppice woods still exist in every county, most of them managed for game, but some, like Hayley, have recently been acquired as nature reserves.

And so this book firmly and elegantly replaces hazy myths of activity in English woods with an altogether more rational picture of the unspectacular yet careful harvesting of a very natural resource. Just how inherently conservationist was the old woodmanship becomes clear in the remainder of this book in which Oliver Rackham brilliantly introduces today's Hayley Wood as a nature reserve of importance and explains in detail the historical and dynamic ecology of its principal woody and herbaceous species. This ancient wood and others like it, contain far more plant and animal species than do other terrestrial habitats in Britain, despite the past thousand years of ceaseless extraction of material from them. In terms of plant species at least, Rackham considers today's old coppice woods to be not unrepresentative fragments of the continuous forest cover of 5000 years ago. If today's forestry and agricultural practices were as

remotely compatible with the well-being of our contemporary flora and fauna there would of course be no need whatsoever for the acquiring of nature reserves like Hayley Wood. However, for those who have the task now, of managing England's woodland 'Noah's Arks', this book provides great insights, with a clear and detailed treatment of drainage and shade as the principal determinants of the distribution of the ground flora within Hayley Wood. For example, slope changes of less than 0.5° are fundamental on heavy clays for determining the major vegetation zones of herbaceous species. Moreover, the flat and wetter parts of the wood contain the scarcer species and the woodland conservationist is warned of the great danger in 'improving' the drainage. Having recently been shown fine new ditches in two East Midland wood reserves, I find the advice timely. An account is also given of the ecology of the eleven acres of coppice plots maintained in the wood by volunteers. Fallow deer have to be excluded from the plots for both young coppice shoots, and the lovely ox-slip, to flourish. Regrettably, there are few requests for the under-wood produced, and the surplus is burned.

Hayley Wood should of course be read by all who manage woodlands, whether commercial or conservation. As it is written in unusually clear English, with positively no jargon, it should also be a priority for all students of the English countryside. For readers of *The Ecologist* and others concerned with a new rural economy it provides a unique basis for considering sensible ways of utilising our native trees.

Jim Davies,

THE Ecology Party Formerly PEOPLE

newsletter



Secretary : Clive R. Lord 44 Upper batley Low Lane Batley
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ABRIDGED MANIFESTO — Now available from secretary.

MEMBERSHIP/PROMOTIONS LEAFLET — requests for supplies to Secretary 10 @ 30p, 50 @ 55p 100 @ £1.

PUBLICATIONS ON POLICY Your suggestions for policy discussion documents, papers outlining policy, requests for publications, offers of help etc. should be sent to policy co-ordinator as soon as possible.

CONGRATULATIONS to Mr. & Mrs. Eric Jones on the recent birth of their little girl, another member in the making we trust.

SARVODAYA CONFERENCE: representatives at this conference at Conway Hall London on 13.12.75 had been useful publicity for the Ecology Party. Edward Goldsmith strongly pressed our cause.

POLICY CO-ORDINATOR Tom Greeves had accepted the post of Policy co-ordinator and circulated a suggested timetable for the submission of amendments to the Manifesto submitted by him.

NEW VALUES: Bernard from the New Values party was asked for the benefit of his experience in New Zealand. In particular, he felt that door knocking had been a necessary chore, but not productive in terms of the effort involved, whilst a crude mobile publicity "office" had been the most effective.

DISTRICT COUNCIL NOMINATIONS: The closing date for nominations was 8.4.76 or thereabouts and the elections would be held on 6.5.76. Candidates please contact John Davenport.

CAMPAIGN OFFICER: John Davenport has accepted this position which is subject to committee ratification.

ANNUAL CONFERENCE: This year to be held on 25th & 26th. September open to paid up members only. Venue to be announced later.

SUBSCRIPTIONS: If you have not yet renewed your membership please do so immediately — To treasurer please.

CORNWALL CONSERVATION FORUM — The Ecology Party has been invited to join in this and are doing so.



cut out and return

To: Elizabeth Davenport, Director for Membership,
 The ECOLOGY PARTY, 2 The Old Vicarage,
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Letters

Scientific Method

Dear Sir,

I value *The Ecologist*, with all its shortcomings, as virtually the only contemporary periodical that offers new perspectives on the life we live now. It is therefore disquieting to read in your editorial for December an indiscriminating attack on "science" and scientific method. To begin with, neither the concerns nor the conclusions of much main-line modern science are as remote from your own as you sometimes seem to imply. Let us take as an illustration of this, chosen not quite at random, the current issue of the *Scientific American*, the other magazine I have on regular order from my newsagent. Its leading article is on damage done to the soil and the productivity of land by strip-mining (most of it sombre in tone in spite of an up-beat last sentence). Another article is on sister-exchange marriage in parts of Africa, and chronicles the harm inflicted on morals and social stability by the intrusion of elements of "modernity" and a cash economy. A third is about entropy, a topic to which *The Ecologist* gave considerable space earlier this year. A fourth is on the ecology of the sand-wasp in Australia, and opens with a tribute to the Aborigines' understanding of their environment. Other topics treated are cell membranes, cataract in the eye, supernovas, and polymers.

The second point is that the study of general patterns of interrelationships, which you define as a "new discipline", can hardly get off the ground until specific interrelationships have been established. Since many of the

most important of these specific interrelationships are covert, they can only be uncovered by means of experimental or observational science to determine "what covaries with what."

Lastly, the view that we can safely rely on our "instincts" (above all in a world far removed from that in which they evolved) is terrifyingly simple-minded. How can we confidently hope to distinguish — in ourselves now — true instincts from custom, conditioning, fashion or idiosyncrasy?

If we understand the essence of the scientific method as a dialogue with systematic doubt in pursuit of the understanding of the natural world, the dangers of trying to do without it are evident: conclusions that are, strictly speaking, capricious; an impossibility of resolving differences of opinion on the basis of reasoned discussion and enquiry; a total lack of conviction to any but the already converted. Personally I think the core of the ecological case quite strong enough to stand up to such a dialogue (even if some of the trimmings are probably not), and certain to be greatly strengthened in turn by it. Is that not really your opinion (and often in times past, your practice) too?

Yours sincerely,

Mark Elvin,

The Oriental Institute, Oxford.

The Scientific American is not a specialist scientific journal, it deals with general topics. I agree with you that it is extremely valuable. The trouble with the study of specific interrelationships in laboratory conditions is that such conditions are totally artificial and do not occur outside the laboratory; also there are so many of them that it is logistically impossible to study more than an insignificant fraction of those that might be relevant to understanding, say, the effect of a single pollutant, let alone the millions that are around on biological organisms.

I agree that our instincts do not provide ideal guide lines for our behaviour in the artificial environment in which we must live, but we have nothing to replace them with. I dealt with the whole matter in 'Is Science a Religion?' in the February 1975 issue of The

Ecologist. In the same article I point out why what passes as scientific method today is not the correct means of understanding the world we live in. It is epistemologically unjustified, quite apart from the fact that 'scientific' solutions to the problems we face today are proving increasingly counter-productive (viz: the chemical warfare we are waging against vectors of plant and animal diseases etc.).
Editor.

Animal Warmth

Dear Sir,

Although we all appreciate the work being done by those trying to find alternative sources of heat and power, through wind, sun etc., it all seems a little too scientific.

The place of the animals seems to have been underestimated. Not only are cattle very good sources of power for cultivation, and horses or donkeys for powering mills of various kinds, but their use for heating houses seems to have been overlooked.

On the continent the fashion seems to be, to have the animals housed underneath the buildings, so that the heat rises. In Wales the old Celtic buildings show double stone walls, with enough room between them to house the animals. In Australia, of course, the Aborigines use their dogs for heat, hence the expression: "A Three Dog Night".

Yours faithfully,

J. L. Burrows,

Goadby Home Farm,
Leicestershire.

Stretching the Rubber

Dear Sirs,

Referring to the article 'Diversify Or Be Damned' in your March/April issue and to the letter 'Not So Well Informed' by Mr. Soper in July, I would like to comment on some statements about the cultivation of groundnuts and tobacco as catch-crops, and other matters.

The cultivation of groundnuts between rows of young rubber trees is not an appropriate way to cultivate rubber as the soil will be impoverished. This plant withdraws a lot of nutrients from the soil, especially during the formation of

the fruit and also needs much water. For this reason, on Java, the practice of intercropping with rice in the paddy fields had to be discontinued owing to the adverse effects on the soil. On the other hand, intercropping tobacco with rice was continued as this helps destroy the wet-rot germs which are persistent. In Sumatra fields which had grown tobacco had to be left 7-8 years so that wet-rot could be controlled and for this reason tobacco should not be cultivated as a catchcrop.

Rubber is the main crop and therefore one has to take measures whereby the rubber trees should be given the best attention for a quick maturing in order that tapping can be started as soon as possible. More attention must be paid to the soil, such as protection against solar heat — insolation — which annihilates the micro-organisms and other lives of the biosphere of the soil. Humus of the topsoil will be lost through insolation and soil particles blown away during the dry season as the cohesive matter which binds the particles is lost. Studying the photograph 'young rubber trees intercropped with groundnuts' I observe that the soil round the seedlings is bare and the plant holes are rather small while the proportions of plant holes intended for rubber seedlings should be 1 x 1 x 1 metre as growing results are better having larger holes than those small ones.

Is Mr. Soper really so well informed about rubber cultivation? His remark that at the end of 3 years the ground would have become so matted with rubber roots that cultivation would be impossible is nonsense. I have never observed during my many years as a planter that the ground under rubber trees was matted after 3 or 30 years by rubber tree roots so that other plants could not grow. Referring to Mr. Soper's remark that 'there are very few plant species which can thrive under such conditions' to wit a dense canopy of rubber trees by the 6th or 7th year at the latest, I can assure him that there are plants capable of thriving under such a canopy, and furthermore, looking at the first photograph and the distances between seedlings and rows it would take at least 10 years for a dense closed

canopy to grow between those rows. I am well versed in opening up new lands for the cultivation of rubber and measures were always taken against erosion — as ground cover I planted a mixture of legumes, creepers and bushes, and this created a high dense green cover which produced a large quantity of leaf refuse and a fine layer of humus. After 3 years the bushes may have dwindled away but the creepers are still going strong. A diversity of legumes will not cause soil fatigue, and tropical soil, not so robust as the soil of the temperate zone, should be covered at all times with vegetation or by a thick cover of mulching material.

Nature tends towards stability. An abandoned site will be covered by weeds, bushes, shrubs, saplings and some trees in about 20 years, and the longer it is not disturbed the greater the diversity of flora and fauna. The summit of a stable environment is a rain forest by its diversity of eco-systems.

Yours faithfully,
P. Jonquiere,
Nassaukade 49,
Rijswijk.

How Dangerous is Municipal Compost?

Dear Sir,

I am glad that *The Ecologist* has given Lawrence Hills' *Fertility Without Fertilisers* such a well merited review. I myself found the first chapter on the four ways that plants feed, worth the cost of the book. And as RLS says Mr. Hills is never dull and his knowledge of composting is unrivalled. Long may he live to inspire the organic movement.

Nevertheless certain statements in the book make me uneasy: anyway Lawrence leaves me with the impression that he regards composting as the *only* way organic farming and gardening can be managed. Well, we have the experience of Arthur Hollins as a farmer and Ruth Stout as a gardener, to mention only two, who do not compost, who are certainly organic and who are successful. Lawrence supports his contentions with such dramatic metaphors as that "digging 4 inches high groundsel into fertile garden soil is like throwing a side of beef into a tank

of crocodiles — everything boils with fury, then all is still and little is left". I should like time to think out the accuracy of such comparisons in all seasons and conditions. In any case there is no need to dig it in; nature mulches. Mulching is easier and composting can become the cult of the connoisseur. And why not? Even so I would not like organic methods to become a dogma, even a good dogma.

Where I really became rather alarmed is when Lawrence imposes a ban on municipal compost and sewage sludge until the heavy metal toxicity has been further researched. Here again there is a hint of dogmatism. Are no exceptions to be allowed? I have made some inquiries on this subject and talked with the manager of the Leicester Composting Plant and the Chief Sewage Officer in Norfolk and others. They have convinced me — unless they were deceived themselves — that careful checks are kept on the constituents of the compost and the sludges and that the Leicester compost and Norfolk sludge are not a risk. One would not use a sludge from Slough, for instance, where local industries are known to contain high levels of toxic metals. Bryce-Smith is right to draw attention to these dangers — but it is a complex subject. Heavy metals can be essential trace elements at one level and poisons at another. What happens to them in the plant is not entirely known, that is, their biological transformations. I am told that at last ADAS is doing research on this. On these grounds, therefore, I recoil from a total ban. Municipal composting is so important — and no one has made this more evident than Lawrence himself — and Leicester in particular is making such progress economically, the only way the authorities will be impressed, that to stop all this when the fight for composting with the local authorities all over Britain is really hotting up, would seem to be a tragic setback. It's advantages have never been more apparent.

Yours faithfully,
Bob Waller.
Trunch, Norfolk.

Coming Events

March 6th
INSTITUTION OF ENVIRONMENTAL SCIENCES and FARNBOROUGH COLLEGE OF TECHNOLOGY. One day Symposium: *Medicine and the Environment*. Programme and application forms from: The Course Organisers, c/o Department of Science, Farnborough College of Technology, Boundary Road, Farnborough, Hants.

March 6th-14th
National Tree Week 1976 — Full details from the Tree Council Room C10/13 A. 7 St. London SW1P 3EB.

March 12th-14th
KEELE UNIVERSITY STUDENT'S UNION CONFERENCE *The Anarchist Society* — an ecological and practical economic perspective. Details from: The Anarchist Group, Student's Union, University of Keele, Staffs.

March 16th
INSTITUTION OF ENVIRONMENTAL SCIENCE *Crime & Violence in Society* at The Royal Society of Medicine, 1 Wimpole Street, London, W.1. Information from: Dr. J. Rose, Blackburn College of Technology, Blackburn, Lancs.

March 25th-26th
LOUGHBOROUGH UNIVERSITY.
Fundamentals of Noise Measurement. Two Day Course: Details and Application Forms: Leverhulme Project, Loughborough University of Technology, Leics.

March 28th-April 2nd
WORLD FUTURE STUDIES FEDERATION. V World Conference — Dubrovnik. Details and Application Forms from: Casella Postale 6203, Rome-Prati. Italy.

April 2nd-4th
LIFE-STYLE WEEK-END CONFERENCE. Opportunity to learn about Life Style and contribute to its future. Application forms & Details from The Deputy Warden, Mrs. D. Eeles, Dartmouth House, Dartmouth Row, London SE10 8AW.

April 5th-9th
WORLD ENVIRONMENT AND RESOURCE COUNCIL. Burssells *The Environment of Human Settlements — Human Well Being in Cities*. Information from: Robert Maxwell, Pergamon Press Ltd., Headington Hill, Oxford.

April 7th-9th
SCIENCE AND RELIGION FORUM
Man's Responsibility for Nature Windsor Great Park. Speakers include Rt Rev. Hugh Montefiore, Professor Derek Bryce-Smith, Mrs. Eileen Barker, Dr. Geoffrey Dobbs. Full details from: Dr. A. Gadd, 25 The Chase, London.

April 16th-23rd
EASTER CONFERENCE ON LAND.
Workshops on various aspects of the politics of land tenure and agricultural policy. £1.75 a day (full board) Booking essential. S.A.E. please for registration forms and further information from: Land Conference, Laurieston Hall, Castle Douglas, Kirkcudbrightshire, Scotland.

April 21st-24th
BIRMINGHAM UNIVERSITY Department of Extramural Studies. *A More Biological Approach to Agriculture and Horticulture*. Course arranged in conjunction with the Soil Association, Organic Farmers and Growers Ltd., and the International Institute of Biological Husbandry. Application forms from the Dept. of Extramural Studies, University of Birmingham, P.O. Box 363, Birmingham B15 2TT.

April 24th
ROYAL METEOROLOGICAL SOCIETY — One Day Discussion Meeting. *Air Pollution* at the University of Manchester Institute of Technology. Information and Application Forms from: The Executive Secretary Royal Meteorological Society, James Glaisher House, Grenville Place, Bracknell, Berkshire.

April 29th-May 1st
THE SOIL ASSOCIATION *Environmental Husbandry* Crewe College, Cheshire. Speakers include Lady Eve Balfour, Dr. E. F. Schumacher, Dr. Victor Stewart, Dr. B. Latto and Mr. Sam Mayall. Course Fee £12.00. One day £5.00. Programme and booking forms from: Mrs. Joy Griffith-Jones, The Soil Association, Walnut Tree Manor, Haughley, Stowmarket, Suffolk.

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