The Ecologist

Journal of the Post Industrial Age No. 10 December 1980 80p

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The Amish — Old Hat or One Step Ahead?

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We take this opportunity to send you our best wishes for Christmas and the New Year,

Ecologically yours,

Editors and Staff of
THE ECOLOGIST

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The Ecologist Vol.10 No. 10 December 1980

The Ecologist

Cover Design: Mike Frost
Photograph: Mary Fisher

Note: While every care is taken with manuscripts submitted for publication, the Editors cannot guarantee to return those not accepted. Articles published in the Ecologist do not necessarily express the views of the Editors.

Published by Edward Goldsmith, Ecosystems Ltd, 73 Molesworth Street, Wadebridge, Cornwall PL27 7DS, UK.
Editors: Edward Goldsmith, Nicholas Hildyard, Managing Editor: Maria Parsons.
Book Review Editor: Ruth Lumley-Smith. Design: Katherine James
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ISSN 0141-6952

Advertising: Maria Parsons, 73 Molesworth Street, Wadebridge, Cornwall. Tel: 020-881-2996

Printed by: Penwell Ltd, Parkwood, Callington, Cornwall.

EDITORIAL

The Cover-up Society

A senior civil servant, Mr Trevor Brown, formerly head of Aldermaston's chemical division which is responsible for processing the plutonium required for making atom bombs, has been seriously reprimanded by the Minstry of Defence, which apparently means that he is now unlikely ever to be promoted.

What is of particular significance is the nature of his 'misdemeanour'. He is accused of having stated on a BBC television programme that "an obsession with secrecy had possibly lowered safety standards at Aldermaston."

Clearly such a statement cannot be construed as jeopardising our national defence. Mr Brown cannot be accused of treachery.

Nor can he be accused of untruthfulness, indeed his thesis has now been vindicated at an official inquiry conducted by Sir Edward Pochin.

What he is in fact accused of is: failure to cooperate with his employers in covering up the now established fact that employees at the nuclear establishment are being subjected, during the course of their work, to unacceptably high levels of radiation.

The only object of such a cover-up is to permit the perpetuation of conditions that must ultimately condemn a lot of people to a slow and lingering death from cancer or to the psychological torture of bringing up malformed children. This, most reasonable people would concede is a more anti-social thing to do than to, say, rob a bank and thereby simply deprive a few people of their surplus cash. Yet unlike a bank robbery it is, in effect at least, quite legal.

The law provides no means of preventing the government and industry from concealing information from the public that it requires to survive in the artificial environment which we have created, nor from providing it with misleading or indeed downright false information, which by the way, Mr Brown would undoubtedly have been expected to do had he been Aldermaston's spokesman on safety matters.

What Mr Brown has been reprimanded for is in fact nothing more than his *refusal to join a callous and cynical conspiracy to commit what should unquestionably be regarded as a serious crime punishable by particularly long prison sentences for all involved.*

If this incident were an isolated one I would not comment on it in the pages of *The Ecologist*, but of course it is not. In the last decades, the public has been misinformed and indeed deliberately lied to, over and over again, both by industry and by government in order to render acceptable to it activities that may be desirable on short-term and political and economic grounds, *but that are highly undesirable on biological, ecological and social grounds and hence that are totally contrary to the medium and long-term interests of the public.*

What is more, many of these activities I am quite sure, would never have been accepted by the public if their true effects had not been so systematically and unscrupulously dissimulated. This is undoubtedly the case with the spraying of 93 per cent of our crops with synthetic organic pesticides, residues of which are present in just about all the food for sale in our shops (see *The Ecologist* special issue on Pesticides, March 1980).

It is undoubtedly the case with the retreatment of spent fuel at Windscale which is leading to the irreversible contamination of the Irish Sea and of its fish life with caesium and plutonium, and it is also the case with the purposeful contamination of our food by the food-processing industry with known carcinogens such as the coal-based artificial colourants.

The trouble is that if the public does not rapidly become aware of the extent to which it is being misinformed on such critical matters then the economy will have become so totally dependent on the continuation of these highly polluting activities that they will then be virtually unstoppable. For instance once our industry has become totally dependent for its electricity on nuclear power, even if an escalating cancer-rate were seen to coincide with the increasing emissions of radionuclides from Windscale and with an increase in the number and seriousness of accidents at nuclear installations, the government could but strenuously deny that the correlation between these trends was anything but purely fortuitous.

It is difficult to avoid wondering how the government is going to render acceptable to the public such biologically suicidal enterprises as must be the projected construction and operation of a range of 1000-megawatt breeder reactors, the large scale 'domestication' of micro-organisms by means of genetic engineering which must inevitably lead to the exposure of human populations to man-made viruses and bacteria of which they have had no evolutionary experience or for that matter the development of the socially-suicidal micro-electronics industry which can only cut down employment in the services sector, the only one that has provided jobs in the last ten years, by a conceivable factor of ten.

In order to succeed in doing so, cover-up techniques will have to be considerably refined. The cover-up will have to become a fine art — the literary genre of the last decades of the 20th century as the novel was of the 19th and the epic poem of the Homeric Age. It will also have to take over from molecular biology and virology as the most glamorous field of scientific research so as to attract ot it the best brains in the business. It will also need to attract the sort of funds to pay for the armies of researchers, copywriters and sundry other propagandists that the government now spends on such things as national health, education and defence.

Only then will it be remotely possible to render acceptable, to the long suffering public, the Frankenstein-like monsters that our scientists have conjured up in what can only be a futile attempt to regild their tarnished image and to resuscitate our collapsing economy.

Edward Goldsmith

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The Amish and the Ethos of Ecology

by Thomas W. Foster

Thomas Foster is assistant professor of Sociology at the Ohio State University

There exists a society in the heartland of industrial America whose values are often the antithesis of those of the dominant culture. This is a society in which communalism is valued over individualism, cooperation over competition, spirituality over material acquisitiveness, healthful work over efficient labor and in which there is a moral commitment to agrarianism and to the use of appropriate technologies, together with a moral rejection of urban life styles and factory technologies.

I am referring to some 60,000 people who are considered to be the most orthodox followers of the 17th century Swiss Anabaptist leader, Jacob Amman, but who are most commonly known as the Amish, and to scholars as the Old Order Amish, to distinguish them from their more liberal New Order brethren. While much has been written about the Amish of the Old Order, the perspective adopted here is unique because it views the basic tenets of Amish culture in relationship to the utopian and ecological ideas that have been promulgated by such contemporary scholars as E. F. Schumacher and Henryk Skolimowski. A primary goal of this article, then, is to explain how Amish life and culture generally correspond to an emerging set of ethical ideas and principles which Schumacher and Skolimowski, among others, have identified as being the hallmarks of an ecologically-balanced, humane social order. A secondary goal is to consider some of the major ways in which Amish society falls short of meeting these moral requisites. Finally, I will briefly discuss what can be gained, both theoretically and practically, from the study of societies like the Amish.

There is no energy crisis among the Midwest's Old Order Amish. At a time when the majority of American society are threatened by steeply rising gasoline costs and recurring shortages, the Amish continue to travel across the countryside at a placid but undisturbed pace — in their black horse-drawn buggies. And as heating oil, natural gas, electricity and coal spiral ever-upward in price, while thermostats in homes and public buildings are turned correspondingly down, the houses of the Amish remain comfortably warm because they are usually heated by wood, a replenishable fuel which is readily available on most farmsteads. Nor do the Amish face the familiar stack of other utility bills that most Americans grimly contemplate each month. Their homes unless connections were made by prior owners. and there are no power-line connections to Old Order homes unless connections were made by prior owners. Candles or fuel oil lamps are used for lighting while water is supplied by wells located on homesites, often being pumped into the plumbing systems of houses by windmills, handpumps or, on occasion, by small gasoline engine-powered pumps. The use of internal combustion engines is limited to such stationary applications and to work that is difficult or impractical to do with horses. There are no telephones, usually no newspapers, except for one — the *Budget* — that is published for the Order, and, of course, no radio or television sets![1]

These deviations from the technological norm are a direct byproduct of the religious values of the Amish whose reverential attitudes toward physical labor partially explains their mistrust of machines and of other labor-saving devices. The Amish fervently believe that manual work is both satisfying and healthful to normal people and that persons who cannot find satisfaction in physical labor are exhibiting a symptom of mental abnormality.[2] They literally believe that idle hands are the devil's workshop and that man is destined to earn his bread by the sweat of his brow. Two practial consequences of these beliefs are that Amish parents try to keep their children "too busy with chores for foolishness or trouble" and that the Amish do not seek to profit financially through investments, insurance policies, legal litigation, or through the loaning of money for interest.

The contemporary Amish think, act, and live much as did many of our agrarian ancestors prior to the Industrial Revolution. For them, the family farm remains the basic unit of social and economic survival, providing most of life's human rewards, many of its required skills, and practically all of its material necessities. Family farms, in turn, are integrated into religious congregations of about 150-200 persons which meet biweekly at members' houses for religious services. The biweekly meetings are social, as well as religious events, and the congregation is the hub around which Amish community life revolves.

The small size of their communities and their religion's insistence upon strict conformity to literally-interpreted Biblical imperatives has contributed to an exceptional degree of cultural consensus and social cohesiveness among the Old Order. Their strong "collective conscience" has largely insulated them from such ubiquitous forms of social deviance as delinquency, crime, alcoholism, and drug addiction. Divorce and family separation are also virtually unknown.

Male and Female Roles

Although farming is by far the major male occupation, there are a few Amishmen who work as skilled craftsmen in such traditional trades as carpentry or furniture-making. Assembly-line work in factories is *verboten*, however, except for temporary periods of financial crisis, and the Amish have otherwise almost completely resisted occupational specialization.

Among Amish women, there is but one fully acceptable occupation and that is being a wife and mother. The role of the Amish housewife, in most respects, is considerably more demanding and difficult than is its (full-time) counterpart in the larger society. On the other hand, Amish housewives seem to be accorded higher status and greater respect by their peers than are their non-Amish contemporaries.

Amish wives traditionally manage large households and perform such tasks, in addition to the ordinary, as gardening, canning and storing food, nursing the elderly, sewing the family's clothing, making quilts, hooking rugs, etc. All of this, of course, must be done without the use of most of the household appliances and gadgets that are normally to be found in non-Amish homes. Despite the "stereotyped" female roles that they are expected to play, Amish women impress outsiders as being unexpectedly confident, forthright and self-assured. Perhaps this is related to their culture's higher valuing of their roles and to the fact that both sexes are taught that mutual respect — and not romantic love — is the most important ingredient in marriage. Perhaps too, it is because Amish women have been relatively isolated from those social forces that have partially defunctionalized the role of housewife and mother in the larger society, i.e., technological innovations, smaller families, and the takeover of traditional family functions by other social institutions.

Education

Amish children begin full-time work in their mid-teens since their formal education terminates upon the completion of grade school. Schools are built and run by members of the community and exist for the purpose of teaching basic reading, writing and arithmetic: skills that are considered to be useful in understanding the Bible and in carrying on the business aspects of farming. The Amish disdain any further "booklearning" or "chairlearning," i.e., conceptual forms of education, and generally believe that what is most important to them can best be learned through on the job training or through other kinds of practical experiences. There are no vocational schools, no forms of higher or professional education and no religious seminaries. Military training is also tabooed because there is a strict prohibition which forbids the bearing of arms against other human beings, even in self-defense. Those rare individuals who do desire to pursue their formal education beyond grade school must first sever their ties with their communities. But, if they choose to follow this course of action, they do so in the full realization that they will thereafter be subject to the ban, or *meidung*, and be shunned, even by members of their families, making it difficult or impossible for them to ever return to Amish society. The ban may be imposed, as well, upon those who marry outside of the faith, or who join the military or go to live in cities or otherwise adopt customs that are associated with modernity and "English" society.*

The rejection of occupational and educational specialization by the Order has several significant sociological connotations, two of which are of particular importance. First, the rejection of specialized roles reduces the emergence of economically-based, and educationally-based, status differences between persons and families, thereby contributing to community solidarity and reducing a major source of societal separation, alienation and competition. A second consequence of the fact that the Amish are generalists is that they are far less dependent, both as families and as communities, upon the highly specialized social and economic institutions of the larger society. Periodic resource shortages, unemployment and boom or bust economic cycles, therefore, have had a minimal impact upon Amish life. Through thrift and intensive agriculture, Old Order families have generally managed to purchase farm land for all of their sons and, consequently, full employment has been virtually guaranteed to all who are willing and able to work. Moreover, when their productive years are over, the Amish elderly have the "social security" of knowing that they will be cared for, for the remainder of their lives, by their children or relatives. In fact, the Amish may be the only ethnic group in the United States to repeatedly send their leaders to Washington for the purpose of lobbying Congress to specifically exempt them from all forms of welfare legislation.[3]

John Hostetler, a sociologist who was raised in an Old Order community until his parental family was banned for their modernism — has written:

> Self sufficiency in the economic life of the Amish people is associated with agrarianism and occupations associated with nature. Closeness to the soil, to animals, to plants, and to weather are consistent with their outlook on life and with limited outside contact. Tilling the soil was not a tenet in Anabaptism but emerged as one of its major values when the movement was banished to survive in the hinterlands.

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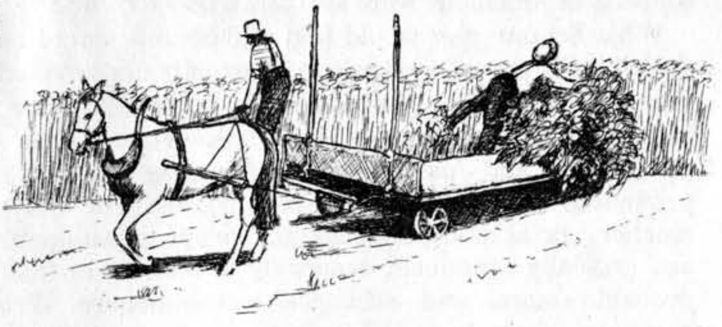
* The Amish refer to other Americans as "the English." German is customarily spoken in Amish homes.



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Hard work, thrift, mutual aid, and repulsion of city ways such as leisure and non-productive spending, find support in the Bible and are emphasized in day-to-day experience.[4]

Hostetler has further stated, "The Amish do not seek to master nature or to work against the elements, but to work with them."[5]

Comparison with other Cultures

From the foregoing descriptions of the Old Order's lifestyle, it is possible to identify two rather remarkable sets of cultural similarities. The first is that Amish religious beliefs in many ways resemble the naturalistic religions of the East, particularly Taoism and the monastic orders of Zen Buddhism and Eastern Orthodoxy. Secondly, the Amish way of life is, to a great extent, consonant with the holistic precepts and emphasis of modern ecology.

With the Eastern religions, the Amish share a reverence for nature and naturalism, for simplicity, unpretentiousness, communal self-sufficiency and pacifism; they share, as well, a deeply rooted suspicion toward all that is new, untraditional or highly ambitious in human projects and undertakings.

An Ecological Community?

The second set of cultural similarities, i.e., to a broadly emerging ecological ethic or moral philosophy, can be better appreciated by relating the previous descriptions of Amish morality to a series of twelve "eco-principles" that have been set forth by social philosopher, Henryk Skolimowski. The following list of ethical precepts are referred to by Skolimowski as characterizing the "emerging philosophy of the 21st Century."[6] While I have added some parenthetical comments for clarification, I have tried to remain faithful to Skolimowski's more detailed interpretations. The resemblance between this 21st century philosophy and the beliefs of the "Old" Order should be immediately apparent.

1. Ecophilosophy is life-oriented, social and public.
2. Ecophilosophy is committed to human values, to nature and to life (and is opposed to rationality and to analytical modes of thought).
3. Ecophilosophy is spiritually alive (and is antithetical to consumerism and materialism).
4. Ecophilosophy is comprehensive and global.
5. Ecophilosophy is concerned with wisdom (not to the mere acquisition of information).
6. Ecophilosophy is environmentally and ecologically conscious.
7. Ecophilosophy is aligned with the economics of the quality of life (bigger is not necessarily better).
8. Ecophilosophy is politically aware (however, political statements are made not so much by voting behavior, but by demonstrating one's political position through a life-style).
9. Ecophilosophy is concerned with the well-being of society (with society being viewed as an expression of man's *spiritual* being).
10. Ecophilosophy is vocal about individual responsibility (rights of individuals should not be delegated to specialists, experts or machines).
11. Ecophilosophy is tolerant of transphysical phenomena (knowledge should, besides being practical, attempt to understand the cosmos, it is "the ladder we climb to reach the heavens").
12. Ecophilosophy is health mindful (one has a moral obligation to preserve one's health).

Rather than attempting to explain how each of the above principles individually applies to Amish life, I would prefer to argue for their general and holistic applicability, while acknowledging the existence of certain exceptions. For example, Amish family size is typically larger than might be considered ecologically desirable from the stand-point of global population growth and, similarly, the Amish sometimes do employ the services of specialists, especially those in the health professions, i.e., doctors, dentists and optometrists. Despite the existence of a few such exceptions, however, several of which could themselves be attributed to the high value which the Amish place upon health and life, I believe the overall correspondence between Skolimowski's eco-philosophy and Amish beliefs remains substantial and valid.

Further evidence for the ecological functionality of Amish ways comes from current trends in American society, which in its very recent efforts to conserve energy — and to preserve health — has increasingly adopted ideas and practices that have long been familiar to the Old Order. For example, a small but growing number of conventional farmers have been emulating the Amish practice of employing draft horses for plowing and cultivation. The use of horses, however difficult, permits a farmer to earn a profit on a small fraction of the land that would ordinarily be needed to make the payments of a large tractor. Moreover, horses eat hay instead of oil, they reproduce themselves, and they provide an excellent source of organic fertilizer.

Yet another evidence of the ecological "progressivism" of the Amish are the recently-evolved subcultures of (non-Amish) woodcutters whose members venture forth from the nation's towns and suburbs each weekend in search of fuel for their newly-installed woodburning stoves. Or, again, we could consider the recent scientific findings that have documented the health benefits of vigorous physical exercise, or of not smoking cigarettes, or of eating garden-raised foods, etc. There is also a large body of scientific studies that have correlated physical and physchological illnesses with differing rates of social change in people's lives and with the stresses of modern forms of work.[7] The list could be greatly expanded but the point is that many Amish customs and practices, which once seemed merely quaint or old-fashioned to outsiders have, since the onset of the current energy/environmental crisis, often been adopted by sizeable segments of the larger society.

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Technology

Finally, evidence for both the ecological — and moral — functionality of Old Order culture may be inferred from a brief consideration of Amish technologies. These are technologies which, to borrow E. F. Schumacher's term, are appropriate or people-centred and are designed to serve the needs of small producers, rather than of huge industrial conglomerates.[8] Schumacher quotes Gandhi as saying that "there should be no place (in Indian society) for machines that concentrate power in a few hands and turn the masses into machine minders, if indeed they do not make them unemployed."[9]

The three criteria of appropriate technologies, according to Schumacher, are: (1) that they be cheap enough so that they are readily accessible to everyone, (2) that they be suitable for small-scale application, and (3) that they be compatible with man's need for creativity. Schumacher believes that out of these three characteristics is "born non-violence and a relationship of man to nature which guarantees permanence."[10]

Most Amish technologies are indeed appropriate when judged by the first two of Schumacher's three criteria. The only criterion which presents a particular problem for analysis is the third. Is plowing with horses, for example, really any more creative than plowing with a tractor? The answer to this question depends upon a number of factors, including the moral value which people place upon working close to nature, or upon working with living animals rather than with machines. Another important factor is the use that non-Amish farmers might make of the *time* that they save by using tractors instead of horses. Does the average non-Amish farmer actually utilize this "free" time more creatively than does the (working) Amish farmer? Or, does the non-Amish farmer employ this extra time to perform alienated work, or to indulge in uncreative leisure-time activities?

These are difficult questions to answer categorically, but I suspect that much, if not most, of the time that is "saved" by machines in American society is ultimately "wasted," in the sense that it is used non-creatively, by the majority of those who operate, or who control, these machines. (The notion of alienated leisure being almost as familiar a theme in Western thought as the concept of alienated work.) In any event, given Schumacher's attitudes toward nature, work and leisure, there can be little doubt that he would view most Amish technologies, as being more creative than their conventional alternatives, at least if the social and economic contexts of Amish life were also taken into account.

What Schumacher would find undesirable would be the typically unreasoned and intellectually unexamined manner in which the Amish tend to reject innovation, including new technologies. This, however, is a separate problem and does not, in itself, negate the appropriateness of their existing technologies. For Schumacher, social innovations should always be rationally and critically examined, especially in relation to their probable moral and ecological consequences. The societal decision to accept, modify or reject a technology, then, should be based neither upon the unexamined traditions of folk societies, nor upon the unexamined economic myths of urban societies, i.e., bigger is better, etc. Reason alone should serve as a guide for the evaluation of social innovations, but the reason of which Schumacher wrote was one that was strongly committed to nurturing and protecting human and animal life and was therefore quite unlike the cyclopian, growth-obsessed rationality of secular societies. From the standpoint of such a morally enlightened rationality, Amish society must surely be found lacking — primarily because of its mistrust of reason — but, perhaps worse, industrialized societies must be found doubly lacking, both in their rejection of humane values and in their misuse and perversion of reason for inhumane ends.

Besides their use of appropriate technologies, the Old Order fulfills several other requirements which, in Schumacher's view, are additional indicators of a balanced and humanitarian social order, these include: self-government, community self-sufficiency, population decentralization, escape from fossil fuel dependency, freedom from consumer-orientated education and freedom from structural unemployment.[11] The latter requirements could almost have been written to describe the Amish and no further evidence appears necessary in support of my original thesis; that is, that Amish culture and social life closely approximate the emerging ideals of ecologically-oriented utopian thought.

A Soul-Destroying Culture?

Probably the most obvious criticism that can be made of Amish society is that the cultural conservatism and social conformity which the Old Order demands of its members outweighs any possible benefits to them and that Amish life is not truly life-enhancing or life-expanding. It can, indeed, be viewed as a lifestyle which, by contemporary standards at least, is severely limiting of human potentialities and creativity. If comparative suicide rates are used as criteria of dissatisfaction, it is noteworthy that the Amish rates are slightly above the national average and are highest for adolescent males.[12] This is a situation which Hostetler attributes, however, not to Amish beliefs alone, but to the psychological confusion which many youths experience when they first come into contact with sharply conflicting *outside* values.[13] If Hostetler is correct, then Amish suicide rates should be lowest in those areas in which their youth have had the fewest contacts with outside social values. Suicide statistics, in other words, should not be simplistically cited to condemn Amish society, for these statistics may equally reflect the influence of the dominant society's values.

The fact that Amish society does stereotype roles and does stifle individual creativity — by the standards of Western societies — indicates, I think, a cultural aversion that is not so much directed against the manifestations of the life-impulse, as it is against those aspects of industrial civilization which are themselves perceived by the Amish as being life-threatening. Nevertheless, the practical effect of this antipathy to the outside world is that a substantial minority of creative and/or non-conforming individuals finds Amish life to be intolerable. Between 5 and 10 per cent of all children, for example, eventually leave their communities.[14] On the other hand, it has been estimated that Amish society is growing twice as fast as conventional society and is expanding into more and more regions.[15]

How can these contradictory trends be reconciled and interpreted? Apparently, the Amish have sacrificed some of the potentialities of a non-conforming minority for the purpose of ensuring the social and cultural stability of a conforming (and growing) majority. According to the sociologist Durkheim, it is the same kinds of social and cultural freedoms that favor the development of the creative genius that also favor the development of the criminal.[16] The Amish, by rejecting industrial civilization almost in its entirety, together with its attendant freedoms and pluralisms, have, at the same time, greatly reduced both of these forms of "deviance" within their society. But, again, have the Amish lost more than they have gained, paying far too high a price for social stability? Perhaps. Yet the repression of individuality in their society most strongly affects a dissatisfied minority and can hardly be compared, in terms of its destructive consequences, with the *failure* to repress individuality in industrial societies. I am not merely referring here to such problems as neurosis or suicide, which are social maladies shared by the Amish, but also to such widespread forms of repression and destruction in modern societies as bureaucratic insensitivity, sociopathic greed, self-indulgent consumerism, corrosive competitiveness, planned obsolescence, environmental despoilation and, particularly, to epidemic rates of irrational violence — from domestic abuse to rape and murder.

Conclusion: Individualism or Community?

Ecology teaches us that there are no free rides and that there is a price to be paid for all human choices. It may be that the defense of individual rights has reached such an extreme in Western societies that the majority are rendered virtually defenseless against certain individuals. If industrialized societies are ever to implement ecologically-sound social and economic policies on a significant scale, it is difficult to see how this could be accomplished without first de-emphasizing the rights of individuals and emphasizing collective obligations. In brief, if a more ecologically sound society is to be attained, people must be taught to exercise, not only their rights, but their responsibilities.

Finally, I do not wish to be misunderstood as suggesting that Amish society can serve as a type of ready-made sociological blueprint for the correction of most of the ills of complex modern societies. The Amish are a people with problems of their own and in significant ways resemble folk societies the world over. As individuals, they typically have little rational understanding of the purposes and functions of their own institutions and they, however gradually, are increasingly compromising with the forces and demands of the outside world. At the same time, there is much that can be learned from these "plain people," for they are in possession of a collective and cultural wisdom which the leaders of industrial societies, despite their rationality and science, seem to lack.

What I am suggesting is that social thinkers and social scientists should re-study folk societies, like the Amish, using perspectives that have been freshened and informed by our growing understanding of ecological principles and relationships. From studies of this kind, various forms of new knowledge can be expected to emerge, some of which may be practical and of immediate usefulness, and some of which may be of subsequent usefulness, either because it improves our theoretical comprehension or because it inspires our sociological imagination to a heightened sense of what is socially possible. Out of such an improved "imaginative understanding" will hopefully come ever-more refined and comprehensive social models; models that may ultimately function as convincing and compelling alternatives to existing forms of industrial social organization.

In the meanwhile, I am convinced that Amish society *can* serve as a viable, visible alternative for a minority of (non-Amish) people in the United States. I am specifically thinking of those families — and collectivities of persons — who want to become farmers but who lack the necessary capital and/or inclination to become involved in large-scale agri-business operations. For these people, the Amish can serve as a living example of what can be done to become socially and economically successful as small-scale farmers. Given a willingness to adopt the form and the spirit of Amish culture — if not its exact content — and given a like commitment to the use of appropriate technologies, I can see no reason why other Americans should not be equally successful.

References

1For an excellent general description of Amish culture and technology see John A. Hostetler, *Amish Society,* rev. ed. (Baltimore: The Johns Hopkins University Press, 1968).

2Ibid., p. 295. 3Ibid., pp. 20-21. 4Ibid., p. 18. 5Ibid., p. 5.

6Henryk Skolimowski, "A Twenty First Century Philosophy," *Alternative Futures,* Fall, 1978, pp. 3-31.

7See Alvin Toffler, *Future Schock (New York: Random House, 1970).*

8See E. F. Schumacher, *Small is Beautiful: Economics as if People Mattered* (New York: Harper and Row Publishers, 1973) p. 34.

9Ibid., p. 34. 10Ibid., p. 34. 11Ibid., pp. 13-39.

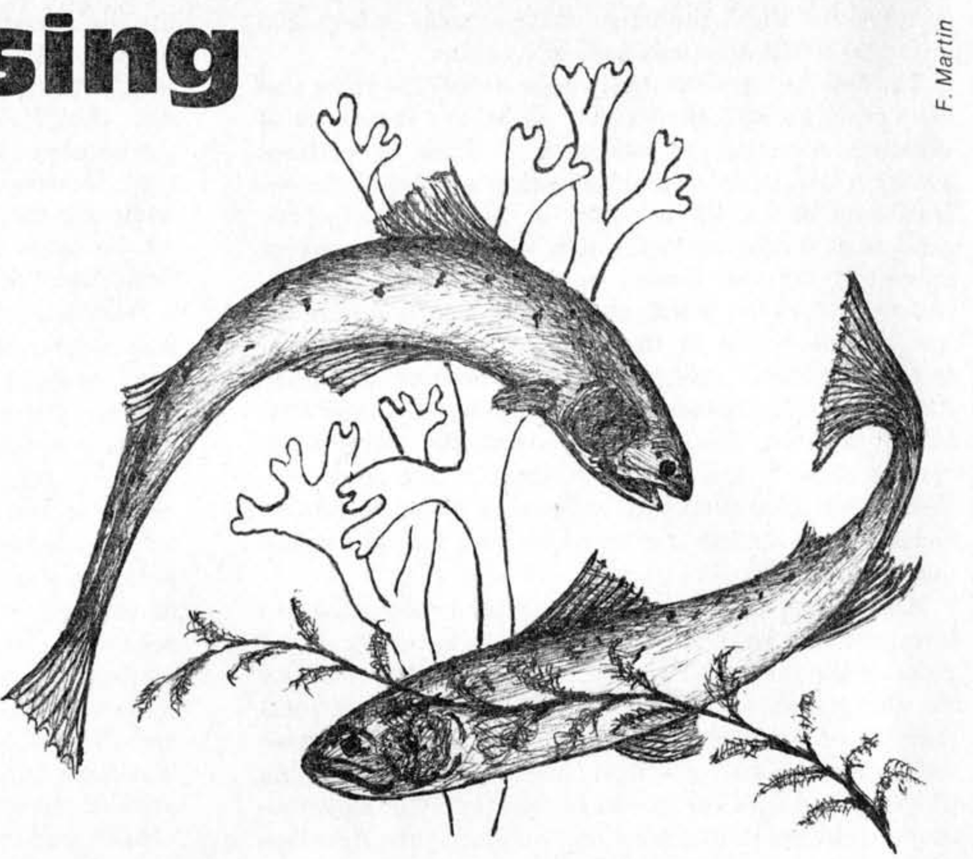
12Hostetler, *Amish Society,* pp. 296-300. 13Ibid., pp. 296-297; p. 300.

14William H. Kephart, *Extraordinary Groups: The Sociology of Unconventional Life Styles* (New York: St. Martins Press, 1976), p.49. 15Ibid., p. 45.

16Emile Durkheim, *Suicide: A Study of Sociology* (New York: Free Press, 1951).

The Passing of the Atlantic Salmon

by Anthony Netboy



Anthony Netboy was English Professor at Portland State University and worked with the Bonneville Power Administration where he developed a strong interest in the conservation of fish. He has published a book on Atlantic and Pacific Salmon. (See The Ecologist, *June 1980)*

Few fishes in the oceans and rivers of the world have attracted as much attention as the salmon. They are native only in the northern hemisphere, in latitudes 40 to 70 degrees, in Europe and North America, home of the Atlantic salmon (*Salmo salar*) and in western North America and eastern Asia, home of the six species of Pacific salmon. Both Pacific and Atlantic salmon have suffered serious declines in abundance in the past two centuries but the Atlantics have now reached a nadir. They have disappeared from many countries and may be on the verge of extinction in others like France and Spain.

When man first entered western Europe, probably towards the end of the last Ice Age, *Salmo salar* was abundant in hundreds of rivers from northern Portugal to the Arctic Ocean. They migrated far into the interior to reach their immemorial spawning grounds, to the foothills of the Alps in Switzerland along the Rhine River and to the foothills of the Urals in the Pechora River in Russia. Salmon are among the world's greatest ocean travellers, criss-crossing the Atlantic (and Pacific) on orbits imprinted in their chromosomes, travelling on a fairly precise schedule of one to four years before returning to their home rivers to spawn.

There were ample runs of salmon in all the Baltic countries until fairly recent times as well as in France, Portugal, Spain and the Low Countries, Scandinavia and the British Isles. Iceland had (and has) small stocks and Greenland one or two rivers supporting salmon. In North America *Salmo salar* is found in numerous streams from Long Island Sound to Ungava Bay.

The earliest known association of man with *Salmo salar* may be seen in caves of northwestern Spain and southwestern France. For example, in a cave near the Vézère River, a tributary of the Dordogne, bones have been found left by Palaeolithic cave dwellers of fish common at that time in the streams — pike, bream, carp, dace and salmon. On the floor of the Grotte du Poisson, about two kilometers from Les Eyzies, there is a sculpture in low relief of a salmon, and another on the floor of the cave at Niaux, near Tarascon sur Ariège in the foothills of the Pyrenees. They are the work of artists who probably lived 20,000 years ago.

The first writer to mention the salmon was Pliny the Elder (1st century A.D.) who in his *Natural History* said that it was the most esteemed of fishes along with mullet in the western part of the Roman Empire. One may surmise that salmon graced many a banquet of the Roman nabobs like those described in the *Satyricon* of Petronius.

The Spanish and French Experience

There are so few salmon now in the rivers of France and Spain, and none in Portugal, that one is surprised to find many references to them in historical and literary documents. Thus in the original play about Don Juan, called *The Trickster of Seville* written by the prolific 17th century Portugese playwright, Tirso de Molina, we are told that the citizens of Lisbon, situated on the Tagus River,

> Can buy great loads of fish
> And most from their own doors are able
> To catch as many as they wish.
> And from the nets where salmon flounder
> It's scarce a stone's throw to the dish.

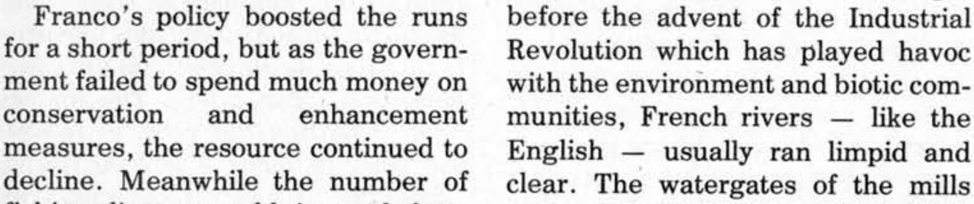
There have not been any salmon in the Tagus for many decades nor in any other Portugese stream, while in Spain only a few thousand are now taken annually whereas in the 19th century catches of 600,000 to 900,000 were recorded. Excessive netting combined with the blockading of rivers by mill dams and small hydro-electric plants built without fish passes, plus the construction of fish ladders at impoundments that were defective or permitted to dry up, prevented the salmon from reaching their spawning grounds on many rivers. In the chaotic period of the civil war (1936-1939) streams were looted by peasants living on the edge of poverty, taking salmon for the pot or needed income.

After General Franco, an ardent angler, became dictator he banned commercial fishing for salmon in 1942 and turned the resource, greatly reduced by overfishing for decades, over to the sportsmen. The salmon rivers were divided into two groups, *cotos* or preserves, and free waters. The *cotos* consist of the Narcea and Deva-Cares in the province of Asturia and the Eo in Galicia; they are among the five best of the dozen or so streams still containing salmon. To fish them it is necessary to have a permit from the State Tourist Department. On the free rivers farmers who have riparian rights can obtain half the fishing licenses for reserved sections of the streams while the remaining half go to sportsmen. The rivers are carefully patrolled by the Guardia Civil, wearing spruce grey uniforms and tricorner patent leather hats, who are known for their toughness.

Franco's policy boosted the runs for a short period, but as the government failed to spend much money on conservation and enhancement measures, the resource continued to decline. Meanwhile the number of fishing licenses sold jumped from about 10,000 in 1950 to 150,000 in 1965, and angling pressure mounted. As a result, *Salmo salar* is barely hanging on in Spain. The late Max Borrell, Franco's fishing mentor and companion, told me in 1974, "After a generation or two, *Salmo salar* will be as dead as the dodo in Spain. I hope I may be proved wrong."

Dissipation of its fabulous salmon is, in the eyes of conservationists, one of the tragedies of recent French history. The Rhine, Loire, Seine, Garonne, Dordogne, Gironde, and Adoyr, complex river systems that issue from the towering mountains and flow across the sweet and undulating countryside, provided ideal habitat for salmon that used to be abundant down to the 19th century. French chefs created some of the most renowned of salmon dishes, as any good French cook book reveals, for as Abraham de la Framboisière, court physician of the 16th century, said, "The tender flesh of the salmon, oily, sweet, very appetizing and excellent to the taste, is preferable as a delicacy to all other fish."

The freshwater fishes were cherished and protected by the Crown and nobility until the Revolution of 1789. "Owners usually took good care of the rivers in order to assure an adequate return of the fishes to the spawning grounds," says Roger Bachelier, historian of the Loire fishery. In the happy agricultural age, before the advent of the Industrial Revolution which has played havoc with the environment and biotic communities, French rivers — like the English — usually ran limpid and clear. The watergates of the mills were closed every night and on Sunday so that the entire flow passed over the channel. When the flow was heavy, arrangements were usually made to permit the ascent of the fish.



Salmon traced on clay ground of a cave at Niaux.

Fishery laws were recodified by Louis XIV's minister Colbert in 1667 in the interests of conservation and attempts were usually made by the proprietors of the rivers to sustain the runs.

After the Revolution of 1789 the nobility was deprived by the Legislative Assembly of its fishing rights, thus opening the streams to the public and to overfishing. Under the Consulate the fishing rights on navigable waters were vested in the state and public fishing was permitted; riparian owners were allowed to take fish on their rivers if they were not navigable. Thus the salmon, always in great demand, were made available to large numbers of people, many of whom, called *Instricts Maritimes* (veterans of the Navy) were given prescriptive netting rights in the estuaries and tidal waters, passed down from father to sons. Protected by the government, they mercilessly netted the salmon and were able to ignore closed seasons and other regulations. At the same time, as in other countries, French rivers were increasingly encroached upon by weirs and mill dams in the 19th century, and some were canalized or polluted. Men of property argued that they had the right to use the waters they owned as they pleased and got away with it, as in the United States and Britain. In the early decades of the 20th century hydroelectric projects, and later nuclear power stations, usurped major salmon rivers like the Loire, making it increasingly difficult for the fishes to reach their spawning grounds.

Fishery officials protested against the overfishing and loss of habitat. They sought to curb the nationalized power agency, Electricité de France, in building hydroelectric projects without fish passes. As Richard Vibert and Louis de Boisset said in their remarkable book, *La Pêche Fluviale* (1944): "To produce kilowatts is doubtless a good thing but it is better in an era of scarcity, and without expense, (to have) food which is as abundant as it is nutritious."

Efforts to preserve the Salmon

Over the years continued efforts were made by conservationists to save the salmon. Occasionally agreements were negotiated by the government bureaux that were in the interest of fishery conservation. Such was the pact promulgated by an interministerial committee in 1929 which set aside seven rivers — the Aulne, Ellé, Allier, Adour (in part), Gave d'Oloron, Gave de Mauleon (in part), and the Nive — on which preservation of the salmon took precedence over industrial use and hydroelectric licenses were no longer granted. On seven additional rivers, mostly in Brittany, the salmon had equal priority with industry and if power dams were licensed safeguards for fish migration were assured. These considerations were not always observed in succeeding years and for every step forward in fishery conservation two steps backward were taken. Salmon catches declined as rivers and parts of rivers went out of production. In the Loire Basin, for example, catches ran as high as 30,000 in some years in the 1890s but thereafter dropped steadily until only 1,350 were recorded in 1962 and much fewer in the 1970s. It seemed to be impossible to persuade the French government to take positive action, to finance the building of hatcheries, subsidize research on a decent scale, curb the netters, and force the dam builders to provide fishways, or undertake any other enhancement programmes. What is left of the French salmon is found in some Breton streams, the Allier, a major tributary of the Loire, and in some affluents of the Adour River. Total catches by anglers and netters probably do not exceed 2,000-3,000 salmon and grilse per year, and sometimes less.

Contemplating the melancholy fate of the salmon, Vibert and de Boisset in *La Peche Fluviale* said:

> Woe to the guardians of wealth who, through ignorance or the crime of carelessness, have permitted the property of which they were the keepers to slip through their hands, since they can be sure that God on the Day of Judgement will make them pass on the left side.

This judgement can be applied to other nations that were once endowed with a cornucopia of salmon and other valuable fishes and let them slip out of their hands, so to speak.

Salmon in other European Nations

Salmo salar has not fared too well in other continental countries. Leaving the Low Countries (Holland and Belgium) with their depopulated rivers like the Rhine and Moselle, we find that the turbulent North Sea used to send a plenitude of these fishes into the Weser, Elbe and other major rivers before overfishing and habitat destruction left them salmonless. The Gudenaa, Denmark's major river, had a sizeable stock as late as the early 20th century, but they have disappeared.

Moving eastward, two major river systems, the Vistula and Oder, draining large parts of Poland and Germany, respectively, and emptying into the Baltic Sea, once teemed with salmon. The Oder is now salmonless while the Vistula supports small runs in a few of the upper tributaries.

A 1975 report on the Baltic countries by the International Commission for the Exploration of the Sea, lists seventeen rivers in Finland, two score in Sweden, and eight major streams in Russia that still produce Atlantic salmon. The ICES estimates that some 4.5 million smolts are sent down to the Baltic annually, of which about 75 per cent come from Sweden and the rest mainly from Finland and Russia. A unique water law in Sweden makes it mandatory for developers of hydroelectric power to replace salmon and other valuable fishes in rivers blockaded by their dams with an equal quantity of fish produced by artificial propagation. Thus the Swedes contribute the largest proportion of salmon found in the Baltic Sea, their feeding grounds but over half of the catches are made by Danish fishermen — Denmark has no salmon left. Russia's Atlantic salmon stocks are small compared to its vast Pacific salmon resource found in the rivers of eastern Siberia. However, the Soviet government endeavours to maintain the runs of Atlantics by a large programme of artificial propagation.

Norway is in a unique position in the salmon world. It has actually seen an increase in stocks in the present century, at least until commercial fishing got out of hand in the 1970s. In the Middle Ages a considerable proportion of Crown revenues came from taxes on salmon and herring fisheries. However, "as the centuries passed," says Magnus Berg, a Norwegian biologist, "and population increased, many rivers were closed by traps or other gear, or by dams, and in some of them, especially in southeast Norway, the salmon almost disappeared." Bagnets, a Scottish invention, became the most popular gear in the rivers; their numbers increased from about 200 in 1875 to 9,000 in 1903. Rivers were festooned with these nets until fishermen discovered they could take more salmon offshore than in the rivers and fjords.

The trend was reversed after World War II as the government began to take an active part in conservation and enhancement. Many hatcheries were built, fishways were erected over difficult cascades and waterfalls, and some 600 miles of spawning grounds were opened up.

Around 1966 there arose an ocean drift net fishery in territorial waters which made serious inroads in the breeding stocks of salmon, attracting German, Swedish and Faroese boats as well as Norwegian. Not until 1977 were regulations for curbing drift netting introduced but the drifters often defied the government and continued to fish with as many nets as they wished until the government promised to pay them full compensation for stopping. The impact of drift netting has been to reduce the runs in many excellent rivers, especially those frequented by sportsmen who come from many countries to hook the prince of game fishes.

Britain: A slow Decline

From the beginning of recorded history the British Isles, blessed with abundant rainfall and numerous rivers, have been renowned for the variety and abundance of their freshwater fishes, of which salmon are the largest and most in demand. There were few sizeable streams in England, Wales and Scotland, as well as Ireland, from which the people in the Middle Ages could not draw much of their food supply. By the 13th century there was already a considerable export trade in salmon from Aberdeen, Glasgow, Berwick and Perth with England and the continent. This trade continued to prosper: for example, in the reign of Charles II some £200,000 worth of

Scottish salmon were being exported annually in good years, suggesting that catches were of huge proportions.

Travellers like Richard Franck, Celia Fiennes and Daniel Defoe in the 17th and 18th centuries noted the prodigality of the rivers. In his *Tour Through the Whole Island of Great Britain* (1724-1726) Defoe records astonishing harvests in some familiar rivers. In Caithness and the north of Scotland, he said, there is "salmon in such plenty as is scarce credible and so cheap that, to those who have any substance to buy with, it is not worth their while to catch it themselves. The fish taken at Perth and all over the Tay is extremely good and the quantity prodigious. They carry it to Edinburgh, and to all the towns where they have no salmon, and they barrel up a great quantity for exportation." And so on.

The Tweed at its peak was a bonanza river. According to the 18th century naturalist Thomas Pennant, a boatload of salmon, and sometimes two, could be taken on a single tide at Berwick, and sometimes up to 700 fish were swept into a stationary net in a day. Farmers in the Vale of Tweed, renowned for colourful nocturnal salmon spearing and similar sports — celebrated by Sir Walter Scott in *Guy Mannering* — depended on the fish for a considerable portion of their winter's food. Such prodigality is now only a memory.

In the 19th century, cotton mills, potteries and other manufacturing plants blighted the Midland counties; iron and steel mills scarred the green Welsh valleys. The mining of China clay defiled rivers in Cornwall and Devon. Bourgeoning industrial cities usurped pellucid rivers and polluted them: Manchester the Irk and Irwell; Liverpool the Mersey estuary; Sheffield arose at the confluence of Sheaf and Yorkshire Don; Newcastle on the Tyne; etc. The pottery towns of Staffordshire ruined parts of the Trent. An anonymous writer penned an epitaph for the Irwell the sentiment of which is applicable to many industrialized streams in Britain:

> If with a stick you stir well
> The poor old river Irwell
> Very sick of the amusement
> You will soon become
> For fetid bubbles rise and burst.
> But that is not the worst.
> For little birds can hop about
> Dry-footed in the scum.

Major salmon rivers of Great Britain.

It took a long time for governments to institute some kind of controls on pollution for the sake of protecting public health. It took much longer to pass laws to safeguard the purity of rivers in order to protect fish and other aquatic life. By 1860 the effects of the Industrial Revolution and exploding urbanization on the fisheries had become manifest. Charles Dickens in his periodical *All the Year Round* (July 1861) sounded the alarm:

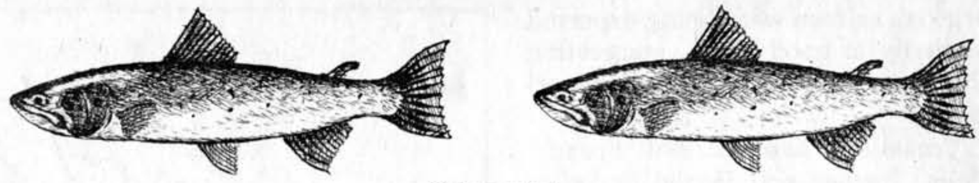
> The cry of "Salmon in Danger!" is now resounding throughout the length and breadth of the land. A few years, a little more over-population, a few more tons of factory poisons, a few fresh poaching devices . . . and the salmon will be gone — he will become extinct.

Dickens exaggerated as usual but he helped to focus on the urgent need for better laws to protect the freshwater fisheries.

In Scotland industrial development and urban growth centered on the Rivers Clyde, Firth and parts of the Tweed, all of which suffered severe fish losses.

Salmon were netted on the Thames as far as Maidenhead until the first quarter of the 19th century. By 1830 there were few left. According to the Thames Migratory Fish Committee report of 1978, the causes of the salmon's disappearance were: (1) "pollution both from untreated sewage and industrial effluents in the metropolitan reaches of the river and some tributaries," and (2) "development of navigation for large boats in the reaches above London which required the construction of the extensive series of weirs and locks. They altered the flow of the river over or through the spawning beds, which were in some cases also dredged out in the interests of navigation."

Considerable legislation was



F. Martin

Salmo salar.

enacted by Parliament after 1860 to recodify ancient laws and enhance protection of the runs and the rivers in England and Wales and in Scotland, but they only slowed down the irreversible decline of the stocks. By 1869, according to the Inspectors of Salmon Fisheries for England and Wales, "only 9,000 square miles out of 36,000 which ought to be productive of this valuable fish produces salmon at all."

To the end of the century more and more rivers lost their salmon due to habitat alteration and excessive fishing. For example, the Tyne in 1872 yielded 120,000 salmon and grilse but by 1900 the catch had dropped to 12,000 and within a couple of decades few salmon were seen spawning in this watershed. Only in recent years have these fishes begun to return, a result of purification.

In the past two decades, catches in English and Welsh rivers have averaged 360 tons per year, including nets and rods, a fraction of what they were a century and a half ago. In Scotland the harvests have held up much better and the resource is considerably larger than south of the border.

Relatively little is being done in the United Kingdom however, to enhance the wild stocks, and pollution still makes many rivers uninhabitable. The Department of the Environment in its periodical reports on the condition of the rivers reveals that most of those in the industrial and heavily populated areas of England and Wales are still grossly or substantially polluted; the purest streams are in Lincolnshire, Devon, Cornwall and north Wales.

Meanwhile the scarcity of salmon has inflated its price and encouraged evasion of laws governing its fishing Large quantities of fish have been taken offshore illegally in recent years and sold to foreign buyers who land them at continental ports where they fetch as much as £15 a pound. In an effort to meet the demand a salmon ranching industry has arisen in Scotland, as in Norway, where the fish are hatched in a hatchery and reared in cages, not being permitted to wander in the ocean. In 1979, owing to the shortage of wild salmon, a substantial poundage of such fish was permitted to be sold in Billingsgate market in London, the largest wholesale fish market in England.

The future of *Salmo salar* in the British Isles, including Ireland, which began to build up its stocks after World War II but permitted them to be overfished in the 1960s and 1970s, is not bright. As an editorial in *Trout and Salmon* (July 1977) warned:

> For the salmon time is running out. It has suffered disease, drought and Greenland netting. Now it has to face even more intensive netting in its own waters. If finally it succumbs to the effects of these accumulated pressures, then so, too, will a whole way of life in Scotland and other countries. If both are to be saved, far more drastic action is needed, and needed soon. In five years it could be too late.

North America

In North America Atlantic salmon have fared much better in Canada than in the United States, owing to the slower pace of settlement and industrialization and its accompanying horrors. "There are almost incredible tales of the hordes of sleek salmon that filled the rivers in Colonial times," says Dr. Wilfred Carter, executive director of the International Atlantic Salmon Foundation, "We are told of streams choked so thickly with ascending salmon that one could almost literally walk from shore to shore on their backs". They were pitchforked by the wagonload in many streams and used for fertilizer as well as food and shipped in large volumes by schooner to Britain.

About 25 New England rivers originally had substantial runs of Atlantic salmon, of which the Connecticut that flows across the states of Massachusetts, Vermont and Connecticut, and the Penobscot in Maine were the most prolific. So abundant were these fishes in the Connecticut that when a housewife in Hartford in the later 18th century went to the fishmongers to buy mackerel or shad she had to take salmon as a tie-in sale!

As settlement spread and industries began to usurp New England streams the anadromous fishes found increasing difficulties in getting to and from their spawning grounds. Already by the end of the colonial period the runs were diminishing in some rivers due to the custom of blockading their migratory routes to impound water for a local mill or settlement. Some communities, like Machias, Maine, passed laws requiring by-passes at dams and gaps in weirs, but they were usually ignored.

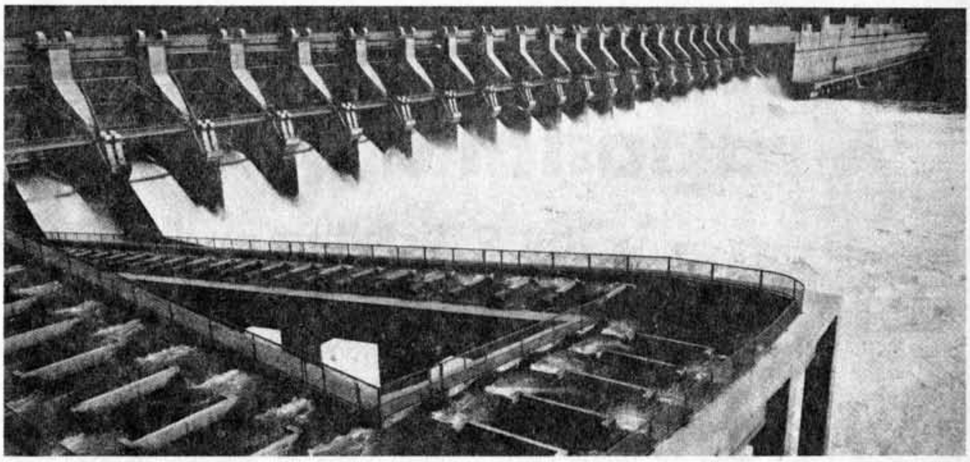
By 1840 there were about 1,200 textile mills in the United States, of which two-thirds were in New England, drawing their power from the rivers. The dams impounding the streams were built with the knowledge they would disrupt the natural flow and harm the fisheries. But the prevailing attitude, as in other countries, was that industry is more important than fish. Industrialists like the Lawrences and Lowells who built the mills on the Merrimack River, that gave the death blow to its salmon runs, were regarded as benefactors of mankind. They provided jobs for many people, contributed large sums to charity, founded educational institutes, endowed chairs at Harvard, and were pillars of society and their churches. They followed, consciously or not, the old Testament dictum that God gave man "dominion over the fishes of the sea and over the fowl of the air, and over every living thing that creepeth upon the earth." It did not bother them that they were helping to exterminate the fishes. They probably never gave it a thought.

When Henry Thoreau canoed down the Merrimack he mused on the fate of the salmon, as recorded in his book *A Week on the Concord and Merrimack Rivers:*

> Salmon, shad and alewives were formerly abundant here, and taken in weirs by the Indians, who taught this method to the whites, by whom they were used as food and manure, until the dam and afterward the canal

at Billerica, and the factories at Lowell, put an end to their migration hitherward; though it is thought a few more enterprising shad may be seen . . .

"Perchance after a thousand years, if the fishes will be patient, and pass their summers elsewhere, meanwhile, nature will have levelled the Billerica dam, and the Lowell factories, and the Grass-ground (Concord) River will run clear again, to be explored by new migrating shoals.



U.S. Army Corps of Engineers

The John Day dam on the Columbia River forms a reservoir 77 miles long. This view shows the northern shore, fish ladder in the foreground, the spillways and powerhouse. The dam was built to produce electric power and facilitate navigation but with other high dams on the Columbia has helped to substantially reduce the once fabulous salmon runs.

Salmon runs virtually ended on the Merrimack around 1860. Later a fishway was erected over the 27-foot dam at Lawrence but very few came back. In 1886 anadromous fish catches on the river were 2,139 shad, 32,400 alewives, and 3 salmon. Efforts to restock the river in the 19th century were futile. One by one the salmon rivers of New England went out of production, and in the 1950s *Salmo salar* was put on the Endangered Species list in the United States.

After World War II a demand arose for public angling for salmon, and a costly restoration programme was launched on eight Maine rivers with state and private funds. Later, when large amounts of federal money became available, the Connecticut and Merrimack were included in the programme. However, depopulated rivers are difficult and expensive to restore, even though scientific know-how is available. Polluted streams have to be cleaned up so the fishes can live in them; fish passes have to be built at hydroelectric dams; hatcheries must be able to produce large numbers of smolts or fry for stocking the rivers.

Up to now the Atlantic salmon restoration programme has not lived up to the hopes of its sponsors. The greatest success has been obtained on the Penobscot where fishways were installed at eight dams at a total cost of about £200,000, tough anti-pollution laws passed by the state of Maine forced polluters to desist from fouling the rivers, and old and new hatcheries have been able to provide the stock needed for repopulating the streams. It is hoped eventually to establish a run of 1200-1300 salmon on the Penobscot, permitting an annual harvest of about 750 for anglers who have exclusive use of the resource. In 1978 and 1979 the catch was less than half this number, and roughly equal quantities of salmon were caught on the other eight rivers in the Maine restoration programme, a poor showing for the vast expenditures entailed.

The Connecticut restoration plan, equally costly, has not yet produced enough salmon to justify an angling season (no commercial fishing is contemplated on salmon in New England). In 1979 only 60 adults returned from the hundreds of thousands of smolts released into the ocean in the previous three to four years. Twenty of these were stripped and the eggs fertilized to create a gene pool which, it is hoped, will become the basis of a native run of salmon again in this vast river, now purified and with many fishways built at dams to permit their migration to the tributaries.

Conclusion

Canada, Scotland, Ireland, Norway, Russia and Sweden account for about 80 per cent of the world's production of Atlantic salmon; Finland, Iceland, England and Wales nearly all the rest. Total catches average 12,000 to 15,000 metric tons a year, and have stayed at this level or declined in recent decades.

The plight of *Salmo salar* seems to get worse every year. In Scotland, says J.R.W. Stansfield, as reported in the latest newsletter of the *International Atlantic Salmon Foundation*, "the most pressing problem . . . is the interception of her salmon stocks by the drift netters of England, Ireland and Scotland." In the United States, according to Lee Wulff, the "greatest danger is that we will not institute strong enough control regulations to safeguard these very special fish." In Ireland, according to Dr. A.E.S. Went, recently retired as chief salmon inspector, it is "the high intensity of the open sea drift-net fishery and the difficulty of enforcing the existing regulations, that is ruining the resource". In Canada, says J.T.H. Fenety, "which has shamefully mishandled its Atlantic salmon heritage," the most important of the many problems "is the inability of the federal government, and to a lesser extent, the provinces, to face up to the very serious situation confronting the Atlantic salmon resource, and to take the many obvious actions necessary for the survival and enhancement of the salmon."

The Danish fishermen press heavily on the Baltic stocks, and their colonists, the Greenlanders (who recently achieved independence) account for about 10 per cent of world harvests by their catches in territorial waters and in Davis Strait — these are fishes issuing from Canada and the British Isles mainly and would return to their home countries if not intercepted on their feeding migrations. Efforts to control high seas fishing have been in vain: the nations cannot agree on a treaty and the European Economic Community, dominated by France and Germany who seem to have very little interest in fishery conservation, refuses to consider any limitation on ocean catches.

Whatever the causes of the salmon's plight, a crisis exists in most of the countries where they are still found in substantial numbers. And time is running out.

Money Down The Drain
A rational approach to sewage

by P.J. Riley and D.S. Warren

D.S. Warren is director and P.J. Riley the ecologist for the Food and Energy Research Centre in Worcester.

Since Roman times, human waste products have been an embarrassment to the British. Our policy has always been to get them out of the house as quickly as possible, either out of the window (*"gardez l'eau!"*) or down the sewerage pipe. However, if an article in the *Sheffield Morning Telegraph* (3/6/78) is to be believed, our flushing system in the future could prove to be rather expensive.

The *Telegraph*, under the apt headline: "Parliament Gets Wind of Sewer Problems", reported that the Yorkshire Water Authority was to spend £11.25 million on replacing sewers and that it had no idea how many of its sewers were collapsing through old age. Sheffield is in the process of spending £26 million on replacing its main sewer. The North West Water Authority is planning to spend £240 million in the next twenty years to renovate its ancient system.

The reason for this sudden need to rebuild its sewers is simple — most are falling to bits. They are mainly Victorian; ones built in the first ten years of this century can be considered modern. The problem is not peculiar to the North and The *Telegraph* reported that the bill to replace all of Britain's ailing sewers could be £28,000 million — a mere £500 for every adult and child!

Given these very nasty economic facts (which would make a big hole in North Sea oil revenue) perhaps we should reconsider the way in which we deal with our waste. In the present system, sewage is treated at sewage works to reduce its toxicity so that it can be discharged into rivers and streams without doing irreparable harm. This system of treatment was devised in response to a series of crises and consequently turned out to be ill-conceived. The first panic measures began after the cholera outbreaks of the 1830s; Exeter led the way by building thirteen miles of sewers in six years after 1842. It was not until the 1854 Broad Street Pump outbreak, when 10,000 died, that the cause of cholera was definitely traced to contaminated drinking water. Sewers were installed at a very rapid rate to protect water supplies, with some success but, alas, without considering the rivers and streams into which the raw sewage was piped. The use of storm water drains (which were also linked to rivers) for sewage disposal was legalised in 1849, although the practice of breaking into drains had become common, illegally, for some time.

The result of this rushed action was to turn many rivers into open sewers. In fact, it was the stench of the Thames which prompted Parliament to form a Royal Commission in 1898 to investigate. This proved to be a prolific body, producing fifteen volumes of reports in twenty years, and it laid the foundations of the sewage works systems of today.

Thus, we have gradually evolved a highly sophisticated system for fertilising the sea. Raw sewage, like all animal manures, contains valuable nutrients for plant growth. Many of these nutrients disappear into the rivers, and ultimately the sea, as "acceptable effluent". We now find that this system, based as it is on Victorian panic measures, when knowledge of plant nutrients was minimal, is going to cost £28,000 million — not to mention the energy used in treating effluents and the lost plant nutrients. There has to be a better way of dealing with this valuable resource and reducing these enormous costs. If the people of this country are to be asked to contribute £500 per head for a renewed sewage disposal network, they should be satisfied that the new system is thoroughly thought out from the start with the benefit of modern knowledge in the relevant fields of physics, chemistry and microbiology. The present system may have been a marvel of engineering in its day: but with a fresh start we could do very much better.

Problems of Waste

There are three main problems associated with human wastes:

(i) Their *oxygen demand.* High concentrations of organic matter added to the natural environment rob the water or soil of its oxygen and create anaerobic conditions unsuitable for higher plants and animals. The power of an effluent to remove oxygen from the environment is expressed as its Biochemical Oxygen Demand (B.O.D.) — the quantity of oxygen it consumes in five days under defined conditions. B.O.D. results from dissolved and suspended organic matter which, although a liability in watercourses, becomes an asset when properly applied to agricultural land. In fact, it has been suggested that the constant removal of this organic matter from the land via food for humans could lead to deterioration of soil structure and reduction in the productivity of farmlands.

(ii) Their *microbiological contamination.* Human faeces contain many bacteria including disease-causing organisms which present a health hazard. In addition, various pathogenic viruses, protozoa and worms may be harboured in the intestine and transmitted through sewage.

(iii) Their *mineral content.* High concentrations of nitrate, phosphate and potassium in sewage can stimulate the growth of water plants and algae in streams, rivers and the sea, disrupting their ecology. On the other hand, if these nutrient minerals can be conserved for use on farmland, they represent a valuable resource.

Our present sewage works deal only with the first of these problems by reducing the organic content of sewage before discharging it to watercourses. The resulting organic product, sewage sludge, may be polluted with toxic industrial products and therefore unsuitable for use on agricultural land. At present most sewage sludge is disposed of either as landfill or by dumping at sea: only 40 per cent is used on the land. The treated liquid effluent still contains high concentrations of bacteria and viruses and much of the mineral content of the raw sewage. As a result, watercourses are contaminated, making many of our rivers unfit for bathing, the ecology of streams and coastal waters can be upset and vast amounts of valuable plant nutrients are wasted.

Bearing in mind the triple target of avoiding water pollution, preventing microbial contamination and conserving plant nutrients, it is worth looking in detail at the chemical and microbiological characteristics of the three materials which make up domestic sewage, namely: urine, faeces and 'greywater' (the mixture of bathwater, laundry and kitchen effluent, also known as 'sullage').

It is clear that the three materials are very different both in their composition and in their requirements for treatment. What happens at the moment is that the three are mixed at the outset, then again mixed with industrial effluents which are often toxic to plant life. Given this noxious mixture it is impossible for sewage engineers to achieve the threefold aim outlined earlier: it is evident that a rational and satisfactory treatment system depends on keeping separate, and treating separately, the flows of urine, faeces, greywater and industrial effluent.

A New Ethic of Disposal

The initiative for rethinking and reorganising our approach to sewage treatment is unlikely to come from the waste treatment authorities, who will have enough headaches patching up the existing network. The scope for experiment lies with individuals and families in isolated homes; with advisors working on new systems of sanitation in the Third World; and in time, we hope, with the experimental communities envisaged in *A Blueprint for Survival.* These communities (which we have taken the liberty of rechristening 'New Villages') will be interested in the conservation of resources and could be pathfinders in the new techniques of waste treatment.

Much of the technology for the separate treatment of waste components already exists and we have to consider how this might be applied in different situations: existing towns and cities, New Village settlements and isolated households.

If plant nutrients are to be conserved by returning wastes to agricultural land, a dispersed population is preferable to very large human concentrations in cities. New settlements give greater scope for achieving an ideal system than existing communities where options are limited by the need to make use of existing buildings and equipment. For these two reasons it is useful to consider first how wastes would best be treated in the ideal environment of a New Village, then to see how the system could be adapted for application in other situations.

Table 1: Characteristics of sewage constituents (average)

	Urine	Faeces	Greywater	Total
Volume (1/person/day)	1.16	0.25	80	130[1]
Nutrient Content (g/person/day):-				
Nitrogen (as N)	10.8	3.4	2.5	16.7
Phosphorus (as P)	1.1	1.1	0.3[2]	2.5
Potassium (as K)	2.0	0.8	—	3.3?
Biochemical Oxygen demand (BOD)	10	24	25	59
Concentration (g/litre) of:-				
N	9.3	14	0.031	0.13
P	0.95	4.4	0.004	0.019
K	1.7	3.2	—	0.025?
BOD	8.6	96	0.31	0.45
Percentage distribution of:-				
N	65%	20%	15%	100%
P	44%	44%	12%	100%
K	60%?	25%?	15%?	100%
BOD	17%	41%	42%	100%
Microbiological contamination:				
Total population	Normally sterile	Very high	Moderate	High
Pathogens	Absent	Assumed present	Usually absent	Assumed present

Sources: Gotaas (1956); Laak (1974); Hypes (1974).

1. Including the 50 1/person/day of pure water at present used for the transport of excreta along the sewer network.
2. Adjusted on the assumption that phosphate-based detergents are not used for laundry.

Isolation of Faeces

In Table 2 the priorities are listed for the treatment of the various sewage components. Perhaps the most important condition which must be satisfied is the isolation of faeces both from watercourses and from people, until all pathogens have been inactivated. The public health hazard of sewage comes almost entirely from the pathogens in faeces and of these pathogens the most persistent are intestinal worm eggs such as those of *ascaris*. Adequate treatments to destroy these eggs include heating over 55 °C for at least an hour (as in thermophilic anaerobic digestion or competently controlled composting) or storage for over a year under hostile conditions (as in the larger composting toilets).

As a general principle, the treatment of faeces is best carried out on a community, rather than a family, basis in order to minimise handling risks. For central treatment, however, transport of the material is essential, either through a pipe or via a collection system. Of these two alternatives, we prefer a system based on collection, since this avoids the waste and contamination of large volumes of clean water as well as the expense of laying an extra network of impermeable sewer pipes.

Obviously, primitive nightsoil collection systems such as those in use in some Third World countries would be unacceptable in the Western world from the viewpoints both of aesthetics and of public health; but a hygienic and acceptable sewage collection system could be based on some of the portable toilets now available for use in caravans and boats. Some of these toilets are equipped with mechanical or water seals so that in use they are at least as hygienic and inoffensive as the conventional water closet. Some have detachable tanks which could easily be exchanged for an empty tank delivered on a regular basis. If appliances such as these could be produced in a more durable material (say glass-reinforced plastics) for general household use, they would be ideal for a modern, clean and efficient system of sewage collection.

One can envisage a service operating in a New Village whereby each household would be supplied with two portable toilets, one for liquids and one for solids. These could be collected and exchanged at intervals and the contents delivered to a central processing depot where faeces would be treated by high-temperature anaerobic digestion (producing methane) and urine stored in readiness for agricultural use. Alternatively, if some loss of nitrogen from the urine were acceptable, one toilet could be supplied to each household and the contents digested together. This would reduce the capital cost and the need for public education.

A sewage collection system of this sort would have to be complemented by a greywater treatment system. In a New Village, with agricultural land readily available, the best solution is probably the drainage of greywater into shallow lagoons for oxygenation. Some nutrients can be recovered from such lagoons by pumping water from them for irrigation in summer and by farming fish and ducks in and upon them, as well as periodically removing weed and mud. Any surplus water overflowing is sufficiently pure for safe discharge to streams.

Industrial effluents should be excluded altogether from these systems. The wastes produced by particular trades are best treated by methods developed specifically for those wastes: in this way the chances are highest of useful constituents being recovered, and the cost of removing any dangerous materials is properly borne by the consumers of the industrial goods produced rather than by the general public. The only exceptions might be quasi-domestic processes, such as laundries and food processing, which produce harmless effluents similar to domestic greywater.

Table 2: Properties of, and suitable treatments for, sewage constituents.

Material:	Urine	Faeces	Greywater	Industrial Effluent
Value:	Contains bulk of plant nutrients in a form readily available for plant growth.	Contains some of plant nutrients in less readily available form. High content of organic matter. Carbon: nitrogen ratio favourable for anaerobic digestion or composting.	Contains some nutrients and organic matter but in very dilute suspension.	May contain useful substances (e.g. metals) in recoverable quantities.
Health Aspects:	Harmless.	Risk of infection: also nuisance due to smell.	Slight health risk and nuisance.	Often toxic.
Priorities in treatment:	1. Prevent faecal contamination. 2. Keep from watercourses. 3. Apply to land at optimum time (i.e. to seedbeds or growing crops).	1. Isolate from people and watercourses. 2. Inactivate pathogens. 3. Apply to land when safe, preferably in Spring.	1. Keep from streams unless treated.	1. Isolate from watercourses and land. 2. Recover constituents if possible. 3. Re-use if possible.
Suitable methods for treatment:	Storage and use on crops.	Storage for over 1 year under hostile conditions or raising temperature over 55°C for 1 hour.	Direct use for crop irrigation, or biological oxidation in lagoons or conventional works.	Specific treatment depends on nature of effluent.

Conclusion

In summary, then, a suitable procedure for sewage treatment in a New Village could consist of (a) collection of urine and faeces in separate sealed toilets for central treatment; (b) drainage of greywater to oxidation lagoons and (c) treatment of trade effluents by those producing them. Adaptation of this scheme for existing towns in developed or developing regions should not be difficult: a simpler sewage collection system based on one toilet per household (or fewer in underdeveloped areas) would probably be preferred as being more familiar; greywater in this country could be treated in existing works but in drier, poorer countries it would probably be lagooned and/or used for irrigation.

Isolated households with adequate land could dispose of greywater by irrigation or lagooning but a more compact solution would be biological filtration followed by discharge to a stream or underground. Urine could easily be collected for use in the garden, but the single-household methane digester is by no means yet a reality so a different approach is needed for treating faeces on this scale. The large and expensive composting toilets such as the Clivus Multrum and Toa-Throne can deal with bathroom and kitchen wastes, although of course much of the nitrogen content is lost during composting. Excluding urine from these units would reduce nitrogen loss as well as lowering the moisture content of the composting mass, which may often be beneficial. The smaller, electrically heated composting toilets fit more comfortably into the average house and the comments above apply also to them. For those who would rather avoid the expense of the larger composting toilets, the energy use of the smaller models and the loss of nitrogen experienced with both, an alternative strategy can be based on the portable chemical toilets which have already been mentioned. Storage of the contents (including the recommended chemical fluid), mixed with absorbent materials such as sawdust, chaff or ashes in a watertight holding receptacle for a year or more should ensure that all pathogens are destroyed while most of the nitrogen is retained. Use of the material on non-food crops gives an extra margin of safety.

Naturally, our choice of methods for sewage treatment is partly subjective and possibly in some situations other procedures might be preferred which lay less emphasis than ours on nutrient recycling and water conservation. Nevertheless we hope to have shown that the existing sewer network is by no means the last word in efficiency; that other methods could fulfil its purpose more satisfactorily; and that as the existing system faces mounting crises, the vital need is for far more radical thinking than has been evident so far.

The capital value of the sewers in this country, not including treatment works, is now estimated at almost two-thirds of a million pounds for every thousand of the population. Of this, over £70,000 — worth per 1000 population is reported to be in urgent need of replacement. A thousand people in a New Village, given merely the £70,00, could build sewage collection and treatment facilities vastly superior to the crumbling network beneath our city streets. The next few generations will inevitably see significant dispersal of population from the cities and a programme of providing facilities for new rural settlements would be a far sounder financial investment than providing large new trunk sewers for the large cities left over from the Industrial Revolution.

With vision and determination, we in this country could so arrange matters that our rivers were pure and wholesome and our farmlands were guaranteed an inexhaustible source of fertility. The alternative is to spend vast sums on the treatment of symptoms (now called 'crisis management') to maintain a wasting asset based on obsolete ideas: truly money down the drain.

References

Gotaas, H.B. (1956) Composting. Sanitary disposal and reclamation of organic wastes. *World Health Organisation Monograph Series No. 31.*

Hypes, W.D. (1974) Characterisation of typical household grey water. In: *Manual of Grey Water Treatment Practice* (Ed. Winneberger, J.H.T.) pp. 79-88. Michigan: Ann Arbor Science Publishers Inc.

Laak, R. (1974) Relative pollution strength of undiluted waste materials discharged in households and the dilution waters used for each. In: *Manual of Grey Water Treatment Practice (Ed. Winneberger, J.H.T.) pp. 68-78. Michigan: Ann Arbor Science Publishers Inc.*

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The Aftermath of Bikini by Glenn H. Alcalay

Glenn Alcalay is an anthropology graduate from the University of California and Rutgers University. He worked in the Marshall Islands as a Peace Corps volunteer to gain medical compensation for the islanders. He has appeared before a Senate sub-committee and the United Nations Trusteeship Council to testify and is writing a book about the radiation problems in the Marshalls.

Glenn Alcalay

Compoj was magistrate of Utirik atoll in March 1965 at the time of fallout.

The Marshall Islands symbolize Homo sapien's arrogance and stupidity, namely, the permanent contamination of untouched beauty in the name of defence.

The newly created Marshall Islands Government (MIG) is about to emerge as a separate entity after thirty-four years of close ties with the United States, the last in a series of foreign rulers.[1] By far, the US has had the greatest impact upon these islanders, and the continuing effects of the US' nuclear testing program pose serious health, ecological and sociocultural problems for these unfortunate people.

Aside from the obvious damage stemming from radiological contamination, there has been additional destruction of Marshallese culture and society following the displacement and consequent "musical chairs" lifestyle of several island communities in order to facilitate the bomb test program. Under US administration in the postwar period, alcoholism, juvenile delinquency and suicide have proliferated, whereas these problems were relatively nonexistent before the US presence in the islands.

Environmental and Historical Background

The Marshall Islands are spread over an area of 375,000 square miles (roughly the size of both Texas and New Mexico) in the North Pacific Ocean, and are the easternmost district in the larger geographical area known as Micronesia. The Marshalls consist of two parallel island chains which run nearly north to south, and the island group is comprised of twenty-nine low-lying coral atolls and five low coral islands.[2] The total land area of the Marshalls is less than 70 square miles, and it is the vastness of the surrounding ocean and the concomitantly intimate relationship the islanders have with their marine environment that truly characterizes the Marshallese way of life. Indeed, the Marshall Islanders are noted in the annals of sea-lore for their long and precarious sojourns across sometimes treacherous open ocean with the use of their famous "stick charts" as navigational aids.[3]

The Marshall Islands were "discovered" by the Spanish in the 16th century, but because of the paucity of land in the Marshalls, the Spanish confined their colonial activities to the Marianas Islands, with Guam as the island treasure. In 1788 an English sea captain sighted Majuro Atoll and the islands were named after him. (The islands will be renamed "Ratak-Ralik" — "Sunrise-Sunset" — after their separation in 1981.)

It was not until the arrival of the German traders and missionaries in the middle of the 19th century that the influence of foreign contact was felt in the Marshalls. The Germans taught the islanders to produce copra from the dried meat of coconut, and in so doing thrust the once-subsistence islanders into a cash economy. At the same time Protestant missionary activity commenced in the Marshalls with the establishment of a mission station at Ebon Atoll in 1857.[4] To this day Protestantism remains as the predominant religion in the Marshalls, and despite the arrival of some Catholic priests during the German period, Catholic influence has been limited to only a few atolls.

Japan became increasingly interested in the islands at the turn of the 20th century, but it was not until the end of World War I and the Paris Peace Conference of 1919 that the islands were officially awarded to the Japanese under a class "C" mandate of the League of Nations.

The Japanese pursued their colonial interests in the Marshalls more vigorously than had the Germans, and they intensified the copra trade and economic activity in general, and aggressively set out to spread Japanese culture in the islands. Japan also looked upon the islands as future settlements to help relieve burgeoning population pressures at home.

Beginning in the late 1930s, Japan began to militarily fortify some of the atolls, such as Kwajalein and Enewetak, and some of the fiercest Pacific battles took place on these atolls when the American forces arrived in 1944.

With the defeat of the Japanese, the US assumed the colonial vacuum in the islands, as Micronesia became a "strategic trust" under the Trusteeship Council — which is part of the Security Council — of the United Nations in July 1947. Micronesia came to be known as the "Trust Territory of the Pacific," and in this unprecedented association of a "strategic trust" under the UN Trusteeship Agreement, the US pledged to:

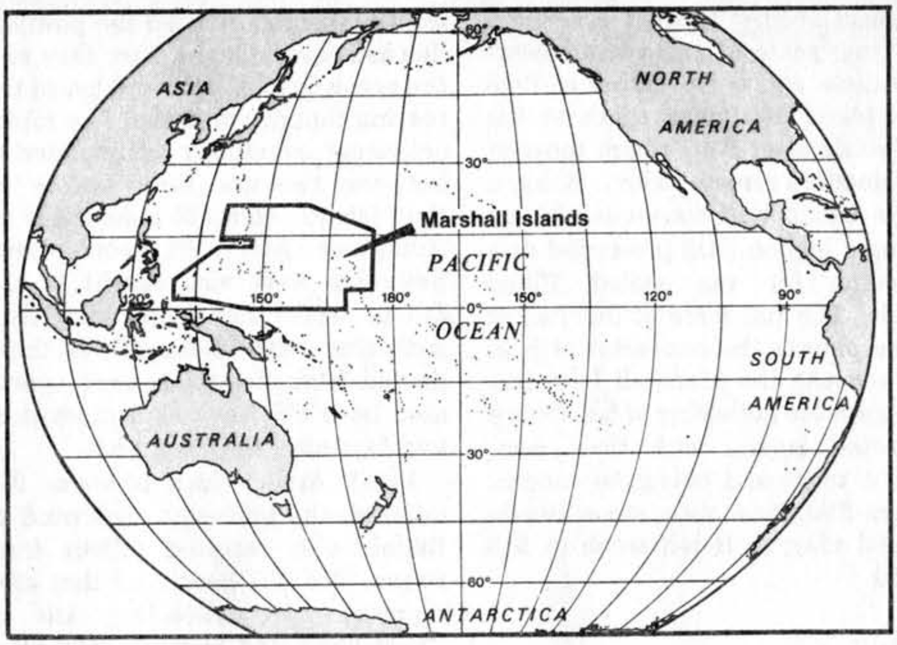
> ". . . protect the inhabitants against the loss of their lands and resources . . ." (Article 76b;2)

and also to

> ". . . protect the health of the inhabitants . . ." (Article 76b;3)

The Nuclear Testing Program

In January 1946, the US Navy — who administered the islands until the Department of the Interior took over in 1951 — cleared the way in Washington D.C. for the nuclear test program in the Marshall Islands, which ultimately included more than 90 atomic and hydrogen bomb tests. Bikini Atoll was selected as the site for the first series of atomic tests (code-named "Operation Crossroads") because it met the several criteria for a prospective test site: (1) First of all, the Marshall Islands "belonged" to the US under the auspices of a UN mandate; (2) Bikini was one of the northernmost atolls in the Marshalls, and the prevailing trade winds in that area would carry any fallout to the north; (3) there was a natural deep-water harbor for naval vessels and research ships; (4) it was out of the shipping and air lanes; and (5) Bikini had a small and politically weak population of only 166 persons in 1946 which made it rather easy to dispense with the indigenous inhabitants.



Trust Territory of the Pacific Islands

In March 1946, the people of Bikini were moved to the uninhabited atoll of Rongerik 140 miles to the east of Bikini, and which has a land area of one-fourth that of Bikini. With little more than two weeks' supply of food and water, and with the carrying capacity of Rongerik being inadequate for a permanent population,[5] the contradictions inherent in the short-sighted and expedient policy to relocate the ex-Bikinians became manifest. During the next several months the islanders on Rongerik made numerous pleas for aid, and when a US physician visited their atoll in 1947 he reported that the islanders were "visably suffering from malnutrition."

In the meantime, Operation Crossroads commenced on Bikini Island with the detonation of two atomic tests, "Able" and "Baker," in June and July of 1946. In all, Operation Crossroads utilized about 250 ships, more than 150 aircraft, and about 42,000 military, scientific and technical personnel, and the juxtaposition between the large-scale operation on Bikini and that of the nearly-starving exiles 140 miles to the east illustrated very early the way in which the US would administer its new "trust."

Following Operation Crossroads at Bikini, the Department of Defense and the Atomic Energy Commission (AEC) announced in December 1947 that Enewetak Atoll, to the west of Bikini, would be needed for the next series of atomic tests. Like the Bikinians before them, the people of Enewetak were forced to leave their ancestral islands, and in another expedient manoeuvre the people were moved to Ujelang Atoll, the most western and isolated atoll in the Marshalls. Ujelang has about one-fourth the land area of Enewetak, and like their former neighbors, the people of Enewetak nearly starved on their new atoll because of the inability of the atoll to sustain a permanent population. There is a lesson in atoll ecology which US officials in Washington continually ignored when it pursued its nuclear experiments in the Pacific: where land is at such a premium — as it most certainly is for these islanders — there is usually a very good reason why some atolls have remained uninhabited, namely, because they are uninhabitable for permanent populations. This insensitivity to Marshallese culture was later articulated by Henry Kissinger, when as President Nixon's Assistant for National Security in 1969, he responded to a question about the affairs in Micronesia by saying "There are only 90,000 people out there. Who gives a damn?"[6]

Meanwhile, the ex-Bikinians on

Rongerik were finally evacuated after two years of misery and near-starvation, and in November of 1948 were taken 500 miles south to the single island of Kili, where most of the islanders remain today. Being a single island and consequently not having a lagoon, Kili presented new problems for the exiled Bikini people. The full force of the Pacific Ocean pounds the perimeter of Kili, and because the Marshall Islanders rely upon the gathering of fish from a protected lagoon with their nets, spears, traps and outrigger canoes, the ex-Bikinians once more nearly starved after their relocation to Kili Island.[7]

BRAVO: The largest US Bomb

On March 1, 1954, the US exploded its second hydrogen device (code-named ''Bravo'') from a 100-foot steel tower on Bikini Island.[8] Within ten minutes of detonation, the 15 megaton yield of Bravo produced a mushroom cloud that ascended to a height of more than 100,000 feet, or about 22 miles.

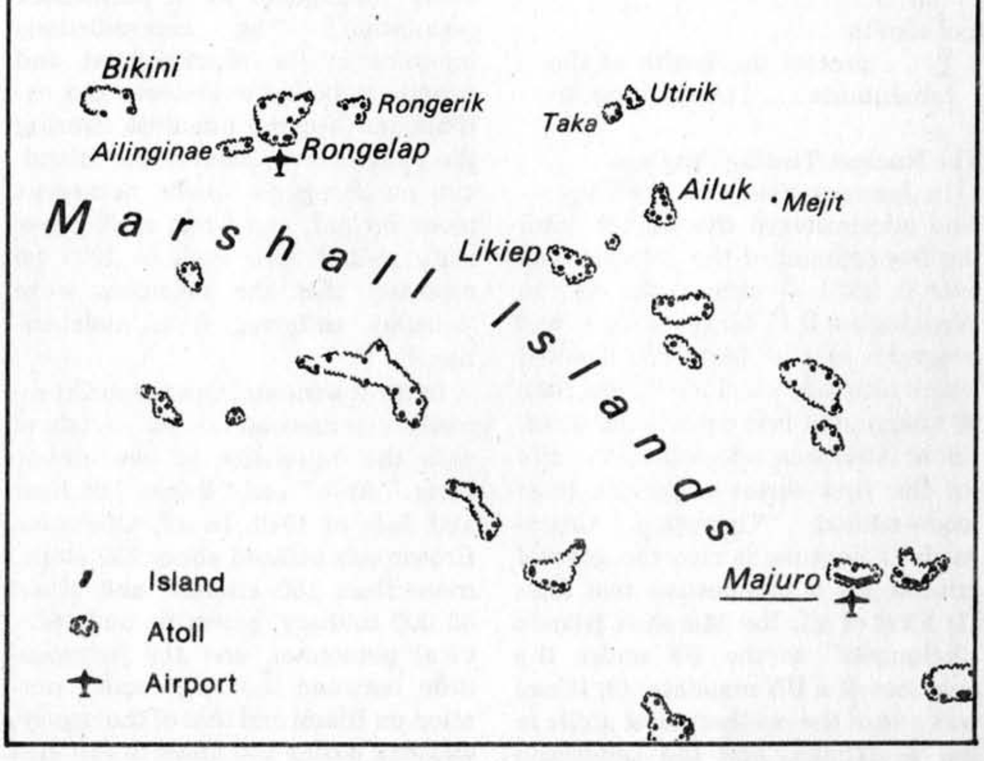
About an hour after the blast, particles of white, gritty ash covered a Japanese fishing boat (the not-so *Lucky Dragon*) with 22 fishermen aboard. The Lucky Dragon had been illegally trawling for tuna in the waters adjacent to Bikini, and after the fallout occurred the fishing boat headed back to Japan. Within a short time afterwards, the radio operator died of leukemia, and most of the other fishermen eventually contracted some form of radiation-induced disease.[9]

On Rongerik Atoll to the east of Bikini, 28 US Rad Safe personnel monitored the hydrogen test, and when radiation levels exceeded the maximum scale of their measuring instruments (100 mrem/hr), they took precautionary measures and remained indoors until their evacuation the following day. Interestingly enough, the fate of these Rad Safe personnel remains a mystery, as there are no published accounts of the medical consequences of their irradiation, and a physician from Brookhaven National Laboratory recently informed me that he was still attempting to locate these people.

At Rongelap Atoll, about 100 miles to the east and downwind of Bikini, the 64 islanders noticed the powder-like ash several hours after they saw the great flash of light and heard the roaring thunder of Bravo. The radioactive ash eventually accumulated to between two and three inches on their island. About 25 miles away on Ailinginae Atoll, 18 people from Rongelap were also caught in the fallout while they were on a fish-gathering expedition. All of these people from Rongelap were evacuated by a US Navy ship more than two days after the Bravo shot.

Utirik Atoll, which is about 275 miles to the east and downwind of Bikini, also received fallout from Bravo. The 157 people on that atoll reported the radioactive ash as ''mist-like'' and because they were unaware of the inherent danger of the fallout, they went about as usual until they too were evacuated by a Navy ship more than three days after Bravo.

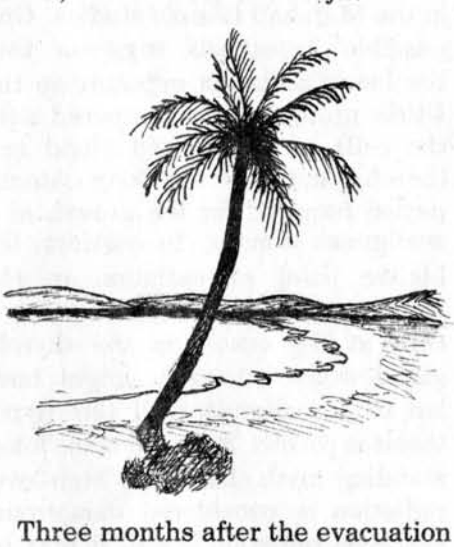
It is interesting to examine some of the peculiar circumstances surrounding the Bravo shot, which was about 750 times as powerful (and ''dirty'' in a radioactive sense) as the Hiroshima bomb. First of all, it is surprising that there were no precautionary instructions given the islanders on the inhabited atolls in the area of Bikini: if they had been forewarned, the islanders would have received a significantly smaller dose of radiation by either staying indoors or in the lagoon during the fallout period. Secondly, despite an alarming meteorological report just prior to the detonation of Bravo which showed winds up to the 55,000 foot level heading in an easterly direction toward Rongelap and Utirik, and with an incomplete report of wind activity about the 90,000 foot level, the decision was made to proceed with the bomb test. Finally, there was an inordinate delay in the evacuation time for the islanders which caused them to receive a maximum exposure to acute high-level radiation.[10] Whether these peculiarities were in fact the result of a series of accidents and negligence, or whether they were the product of an intentional ploy to use human beings as guinea pigs for radiation studies will probably never be known for certain, and the reader is left to make this judgment. It should be added that the US Congress is presently reviewing a bill to compensate the estimated 400,000 ex-GIs who were irradiated during the atomic test program in New Mexico and Nevada during the 1940s and 1950s. Many of these people are now suffering from radiation-related diseases.



Medical Effects of BRAVO

All of the 239 irradiated Marshallese were evacuated and taken to Kwajalein Atoll,[11] where a special team of 23 radiation experts were flown in from the US. While on Kwajalein, the exposed Marshallese suffered the primary symptoms of acute radiation sickness, which included nausea, diarrhea, and itching and burning of the skin. During the second phase of radiation sickness, about two weeks after irradiation, medical examinations revealed that about 75 per cent of the exposed people suffered from beta skin burns. Whole-body counts (WBCs) were performed and blood tests showed that blood platelets fell to about 50 per cent after 25 days, while the white blood cell count fell to its lowest point about 50 days after irradiation. Additionally, numerous cases of stillbirth and miscarriage were reported during the early phase of radiation sickness, and many people suffered the loss of body and scalp hair, or epilation.

All of the irradiated Marshallese received an acute dose of high-level radiation. Estimates of radiation dose were extrapolated from minute traces of radioisotopes present in urine samples, and also from crude measurements of radioactivity on the affected atolls. Based upon these estimates, it was calculated that the people of Rongelap received an external gamma dose of 175 ($\pm$ 25) rads, whereas 300-500 rads without emergency medical treatment are considered lethal. The people from Rongelap who were on Ailinginae, which is only 25 miles from Rongelap, received a dose of 69 rads due to the steep gradient in the exposure between the two atolls. Finally, the people from Utirik received a dose of 14 rads. It should be pointed out that these figures refer only to the external whole-body dose of radiation, and exposure to specific parts of the body (such as the thyroid gland) may have been ten times higher due to the properties of ionizing radiation. Also, it should be mentioned that these numbers are mere estimates, and at the present time radiation experts are still working on the dosimetry associated with the Bravo shot of 1954. In fact, several people from adjacent atolls have contracted radiation-induced diseases: it is now believed that the fallout pattern from Bravo was far more extensive than originally thought, and may have affected the atolls of Likiep, Ailuk, Bikar, and the island of Mejit.



Three months after the evacuation in March of 1954, it was decided that the people from Utirik could return to their home atoll in light of their relatively low exposure to 14 rads.

The people of Rongelap were not so fortunate however, and were moved to Majuro Atoll (the district center) for three years after the Bravo bomb because of their much higher exposure. In July 1957, an Atomic Energy Commission radiological survey concluded that "despite slight lingering radioactivity" on Rongelap, it was safe for the people to return home. Along with the exposed people from Rongelap were several Rongelapese, who were not residing on Rongelap during the fallout period, and the US medical team decided to use these unexposed people as a control group in order to compare the effects of radiation between an exposed and an unexposed group of islanders. In retrospect, this turned out to be scientifically unsound because *the previously unexposed group became exposed* due to their uptake of radionuclides through the foodchain on Rongelap. In 1971, a Japanese medical team stated: "Our conclusion concerning the human test on the people of Rongelap is that it was a great mistake to permit the people of Rongelap to return to their island in July 1957 without sufficient work having been done to remove radioactive pollution from the island."

After the Bravo shot of 1954, the AEC assembled a medical team from Brookhaven National Laboratory (BNL) on Long Island, New York, and this medical team has conducted regular examinations of the exposed Marshallese. In their 3-year report on Rongelap and Utirik, the BNL team concluded that "The group of irradiated Marshallese people offer a most valuable source of data on human beings who have sustained injury from all possible modes of exposure."

Aside from the numerous cases of stillbirth and miscarriage in the ten years after their initial exposure, it was assumed by the BNL medical team that things were returning to a normal state in the exposed populations. Then in 1964, *ten years after exposure to the fallout from Bravo,* a few cases of thyroid abnormality (i.e. "hypothyroidism") were discovered in the Rongelap group. Since that time about 40 thyroid tumors have been found in the Rongelap group, with four of these tumors having been diagnosed as malignant. It should be stressed that more than 90 per cent of the people who were under the age of 12 during exposure have contracted thyroid disease. And on Utirik, 16 cases of thyroid tumors have been diagnosed, with three of these being malignant. All of the people who have contracted thyroid tumors have had surgery to remove their thyroid gland and the tumors, and all of the exposed Marshallese must now take a daily dose of a synthetic thyroid hormone (called T-4 Synthyroid) for the rest of their lives.

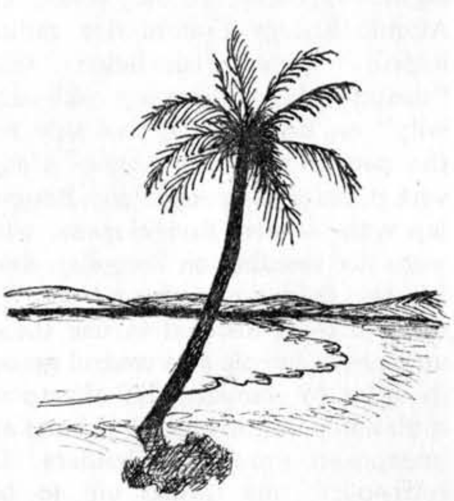
The BNL researchers cannot fully explain why there is a much higher ratio of thyroid cancer in the Utirik group, where they received less than one-tenth the radiation of the Rongelap group. Also, in 1972 a young man from Rongelap who was a year old at the time of Bravo died of myelogenous leukemia, and is the only known leukemia victim thus far. It should be pointed out that one of the major obstacles for ascertaining disease figures in the Marshall Islands is the absence of any background information on the random occurrence of disease. What is sorely needed (and has yet to be accomplished) is a comprehensive epidemiological study in the Marshalls, and I have just learned that the newly-appointed head physician for the BNL medical team has just resigned because of the US' refusal to conduct such a study.

Several clues about late-occurring radiation effects have been uncovered from the BNL studies of the exposed Marshallese. For example, it is now known that Rongelap and Utirik received rainfall after the fallout had accumulated on their islands. Since the people rely on water catchment systems for some of their drinking water, it is easy to understand how fallout, that had settled on the tin roofs of the catchments would have been washed into the supplies of drinking water. The level of *internal* radiation absorption would therefore be determined not only by the volume of water consumed, but also by the amount of food eaten before evacuation in 1954. This would help explain some of the great variance in individual doses and in the incidence of radiation-induced disease.

Another point to consider is that aside from cesium-137, strontium-90 and other radionuclides emitted from the Bravo fallout, radio iodine-131 (with a half-life of 8 days) and the other short-lived radio iodines are believed to be the culprit isotopes responsible for the thyroid abnormalities. A radiobiological phenomenon is that the thyroid gland is fooled by the unstable radio iodines, and the thyroid readily absorbs these isotopes because of their resemblance to normal, stable iodine.

Also, one of the most important facts to be derived from all of the radiation studies in humans is that *age at irradiation is crucial* in terms of the effects. That is, the younger a person is at the time of irradiation, the more susceptible they are to radiation-induced pathologies. Since the thyroid gland of a child is about one-tenth the size of an adult's (1-2 grams at birth compared with 18 grams for an adult's), young children are at a much higher risk for contracting thyroid disease. Put another way, if you take the same amount of radio iodine-131 and put it into the thyroid gland of both a child and an adult, the child would receive ten times the concentration of the isotope than would the adult. This explains why so many of the Rongelap people who were under the age of 12 at the time of the fallout have contracted thyroid disease.

The question concerning the much higher ratio of thyroid cancer in the Utirik group (which received less than one-tenth the radiation of the Rongelap group) has indeed been one of the more perplexing enigmas in the Marshall Islands studies. One possible hypothesis suggests that the lower radiation exposure in the Utirik group merely tampered with the cells of the thyroid gland and thereby initiated the long latency period required for the growth of a malignant tumour. In contrast, the higher level of radiation in the Rongelap group may have destroyed cells at the outset in the thyroid gland which otherwise might have led to a malignancy. If this hypothesis is correct, it explodes the long-standing myth that while high-level radiation is considered dangerous, low-level radiation is not. It may be that low-level radiation merely has a longer latency period for the development of a malignancy or a benign neoplasm. For this reason low-level radiation has recently been re-evaluated and is now considered to be much more deleterious to human physiology than was previously believed.



Conclusions

The legacy of the US' nuclear testing program is continuing to plague the Marshall Islanders. The people of Rongelap and Utirik who were exposed to acute radiation from the fallout of the US' largest hydrogen bomb 26 years ago are still contracting radiation-induced diseases, and their future is uncertain.

In 1969 it was decided by the AEC that the exiled Bikinians could return to their home atoll. Rehabilitation efforts were begun in the early and middle 1970s, and by 1978 about 140 people had returned to Bikini. When an AEC radiobiological survey reported in 1978 that many of the returned Bikinians had absorbed dangerous levels of residual radionuclides (notably cesium-137, strontium-90 and plutonium-239) through the foodchain, the people were *once again evacuated* from Bikini. The ex-Bikinians are presently lobbying the US Government in the attempt to reinhabit their home atoll.

On Enewetak, where a massive 105 million dollar clean-up operation has been recently completed, the exiled Enewetakese are also trying to return home. The proposed Enewetak return poses many serious problems for the returning islanders because of the great variation in residual radiation found on each of the islets in the atoll complex. An alleged "independent" radiation assessment of Enewetak (which was conducted by radiation experts affiliated with the US Government) recently concluded that it was safe for the Enewetak people to return home. Independent radiation experts outside the Government have criticized this recent assessment because it under-estimates the radiation risks at Enewetak. This discrepancy poignantly illustrates the continuing uncertainties about the health risks associated with radiation. The ultimate decision about the Enewetak return is presently being considered by the Department of the Interior after much infighting between various Government agencies.

I think it is important to compare the unfortunate fate of the Marshall Islanders with the health risks of the people who live adjacent to the nuclear reactor of Three Mile Island, or any population living near a nuclear facility or a waste disposal site. During the early phase of the partial core meltdown, there were unknown emissions of radionuclides, including radio iodine-131. The Nuclear Regulatory Commission maintained that these emissions were "below those considered dangerous for humans." But in fact, the exact radiation levels are still unknown, and we may not know for several years just how much radioactivity was released into the atmosphere and local environment. Already there is some evidence that damage has occurred: the Pennsylvania State Board of Health has concluded that there has been a five-fold increase in birth defects in the area downwind of the TMI reactor during the year following the accident. The people near TMI, like the Marshallese, may some day ask why they were not evacuated during the reactor accident.

As a species in the nuclear age, we face dire threats to our survival. Our geopolitical situation is certainly more unstable as the dangerous notion of "limited nuclear war" gains momentum within government circles, and as the potential for nuclear terrorism by sub-governmental groups becomes a contemporary reality.

In order to prevent further diasters which nuclear technology spawn, it is imperative that we learn about the grim medical consequences of the Marshall Islanders who were exposed to radioactive fallout.

Footnotes

1 The Marshall Islands, along with the Federated States of Micronesia (which includes the districts of Kosrae, Ponape, Truk and Yap) and Palau in the Western Carolines will enter into an arrangement known as "Free Association" with the US. This new arrangement entitles the separate island entities to conduct internal and foreign affairs with certain limitations, while the US retains the authority to maintain security interests and defense commitments in Micronesia. For an excellent review, see Roger S. Clark, "Self-Determination and Free Association," Harvard International Law Journal (21:1), Winter 1980, pages 1-86.

2 An Atoll is the uppermost part of a submerged volcano built up of coral polyps. A typical atoll is a necklace-like chain of islets which encompasses a lagoon, with an elevation rarely exceeding 30 feet above sea-level. For a thorough treatment of coral atolls, see Herold J. Wiens' *Atoll Environment and Ecology,* Yale University Press, New Haven, Conn. 1962.

3 For a fascinating account of traditional Marshallese sailing, see William Davenport, "Marshall Islands Navigational Charts," Imago Mundi, (XV), 1960.

4 Alexander Spoehr, *Majuro: A Village in the Marshall Islands,* Fieldiana: Anthropology, Volume 39, Chicago Natural History Museum, (1949), page 31.

5 In addition to the food shortages, several species of reef fish which were edible on Bikini were found to be poisonous on Rongerik, which lent credence to the historic legend that an ancient spirit had poisoned the fish in the Rongerik lagoon, and which accounted for Rongerik never having been inhabited.

6 Donald F. McHenry, *Micronesia: Trust Betrayed,* Carnegie Endowment for International Peace, Washington, D.C., 1975, page 98. McHenry is currently the US' representative to the United Nations.

7 See Robert C. Kiste, *The Bikinians: A Study in Forced Migration,* Cummings Publishing Co., Menlo Park, California, 1974.

8 The first hydrogen bomb, code-named "Mike" was exploded on Enewetak in October 1952 with an estimated yield of 10.4 megatons.

9 The US paid the Japanese Government $2 million in compensation a few years after the incident.

10 See the Congress of Micronesia's "Report on the People of Rongelap and Utirik, 1973. This report was written after the leukemia death of Lekoj Anjain in 1972.

11 Kwajalein Atoll encompasses the largest lagoon in the world, and is used as a target for missiles fired from Vandenberg Air Force Base in California, about 5,000 miles away. It has recently been learned that some of these missiles carried uranium in their nose cones, and that this uranium has now contaminated the lagoon at Kwajalein.

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Educating Engineers

Questions of Professional Responsibility

by

Peter Hartley

Dr. Peter Hartley is a cultural ecologist who teaches in the Humanities and Social Sciences Department at the Colorado School of Mines and was consultant to the Ford Foundation. He has published articles on American studies, engineering ethics and environmental issues.

The development of modern technology has been a great adventure that many people have justly regarded as the conquest of nature. Until recently, most engineers have prided themselves on making this conquest possible. Many, perhaps most, still do. What other attitude is possible for them? Can engineering be anything else but the conquest of nature?

Perhaps it is obvious from my tone that I find the conquest of nature questionable at best. Yet I must immediately make clear that I am not speaking from across a supposed gap between the so-called "two cultures"; I am not opposed to engineers or engineering, nor am I ignorant about them. I teach American Studies, Mythology, and Technical Writing to engineering students, and I cannot take pride in what I do unless I can take pride in what they are going to do. The question involves my professional integrity as well as theirs. I cannot have professional integrity unless my students learn to have it. Therefore, although I am not an engineer, the issue of professional responsibility in engineering is inseparable from the issue of my own professional responsibility, and it is also inseparable from the day-to-day problem of how I should approach my teaching. Further, the professional attitude of future engineers is crucially important to society. It may be one of the most important issues we can address.

If I were a humanist, my problem would be immensely complicated and probably hopeless. Fortunately, I am not a humanist. I am a cultural ecologist with a literary background. Therefore, I can set to one side the "two cultures" approach, which completely blocks any meaningful resolution of the question. I can point out with no discomfort that the past attitude of engineers bears a close affinity, not to the vocabulary or preoccupations of those who consider themselves humanists, but to the dominant conception in our society about the supreme importance of strictly human interests in the general scheme of life. Humanism, if not the cause is certainly the essence of that ignorantly anthropocentric outlook. If as J.B. Bury suggests we may call Diderot a humanist, then by the same token we may say that engineers have been humanists.[1] Nor is the stance of Diderot very different in its ultimate significance from that of Renaissance thinkers like Marsilio Ficino and Pico della Mirandola.

To forestall quibbles, I immediately admit that there are important differences between Renaissance metaphysics and the original Renaissance literary cult that first became known as humanism. Diderot is more distant still from the literary ideal as such. Yet the pressure of history allows us no choice but to use the term "humanism" for that relentless trend in which, from our perspective now, they all take part and become identifiable with the purposes that have guided engineering, as well as guiding the thrust of society. That trend is the ever increasing tendency to consider human life apart from all else — a tendency which inevitably becomes indistinguishable from the assumption that life has no value apart from human purpose. This humanist view displays and indeed constitutes humanism's inherently non-systemic, non-ecological character.

Moreover, although an outlook such as Pico's set forth the notion of human improvement in terms which abjured any concern for bodily welfare, the pressure of historical assimilation has made all forms of improvement inseparable under the rubric of "progress". Progress promises a general amelioration of human life, making possible for everyone good education, cultivated humanistic sensibility, and not only the provision of bodily necessities but the addition of every material comfort. That education, insofar as it has been attainable, has of course been a humanist education singing the praises of human achievement through the power of human intellect, and in effect defining the world as something for that intellect to exercise itself upon. Even material comfort itself is subsumed under the purposes which humanism in its more self-conscious moods likes to dwell upon; I have heard people maintain that material progress is necessary to provide us with energy slaves so that we can all be free to spend more time exercising our more purely human (i.e. mental) faculties.

In short, there is a comprehensive ideology we may fairly call humanism, without necessarily having in mind any one of the parochial ideologies that went to shape it as a cultural and social trend. It is the dominant ideology of modern times, comprehending as it does both capitalism and socialism, and being not merely an ideology, but the practical commitment of every society that is modern or trying to become so. Its main practical effect is to increase without limit the per capita amounts of resource use, pollution, and environmental destruction. Its rationale is basically its commitment to human self-importance — a generalized human egotism that encourages socially and environmentally corrosive egotism in every human individual.[2] Without doing any injustice to the post of today's self-conscious humanist, we may say that the fundamental aim of humanism is to *improve the human condition.* In practice, this means that engineering has indeed been at the service of an outlook that at its foundation is humanistic. Modern engineering has, in fact, had no other purpose.[3]

Engineers follow notions of improvement set forth originally by poets and philosophers dreaming a world of perfect felicity for man. In its engineering manifestation, then, humanism contrives to manipulate the environment in ways that its philosophical and literary manifestations deem beneficial — to make improvements that accord with human purposes. The attainment of such improvement is called *progress,* which has been the essential meaning of humanist thought as that thought has evolved to dominate society. In those terms we can even regard modern science as a creation of humanism. Operationally, modern science has been humanism's technique for defining the world as a manipulable object and for discovering the basis for effective procedures of manipulation. Engineers have simply applied those procedures in carrying out projects determined by humanistic notions of improvement.

The question of professional responsibility before me as an interdisciplinary generalist teaching engineers — and by rights even more urgently before engineers themselves — boils down to whether we can define full professional adequacy in engineering merely as technical competence to carry out such projects. In terms of cultural ecology, this amounts to asking whether we should try to establish a radical separation between engineering and humanism to replace the fantasy separation that our cultural self-delusion has maintained. I started out by asking whether we had to identify engineering with the conquest of nature. In fact, *humanism* is the conquest of nature. This is humanism's fundamental arrogance and irresponsibility. Engineers like to think of themselves as being committed to responsibility. Can engineering turn away from the conquest of nature? Can engineering behave with full responsibility? Can there be a non-humanist engineering?

I do not intend here to argue for nature in terms of wilderness as such, though what I say *mutatis mutandis* can apply in principle to the protection of wilderness. However, the most immediate difficulty inherent to the project to conquer nature is its effect on *human nature* — its deleterious effect on society, and the concomitant diminution of human personality which results from the loss of sustaining interpersonal fabric. Humanistic egotism makes people unable to know society as anything but an aggregate of separate egos, or the earth as anything but an aggregate of mere non-human bits and pieces. But notwithstanding the vaunted importance of those isolated egos, they become objects of manipulation just as surely as the bits and pieces of estranged nature do — and by means of the same process. The industrial system is impossible unless most people in the industrial machine obey orders like robots. In *The Abolition of Man,* a good book of uneven perspicacity, C.S. Lewis states a number of penetrating truths. Here is the most important one: "Man's power over Nature turns out to be a power exerted by some men over other men with Nature as its instrument."[4] That, and not the environmental problem as usually conceived, is the most immediate professional dilemma of the engineer.

The exaggeration of separate human importance has created a general social estrangement such that the individual can have no real significance. There are no longer any transcendent interpersonal bonds that can confer fully differentiated individual significance.[5] Engineering has contributed to this situation not only because it has created the technological basis for industrial production as such, but also because industrial technology has been the means whereby the isolation of individuals in socially irrelevant modules has become possible Survival — even comfort — has become possible without reference to others. People's material needs are provided for not through binding human contact, but through mere distribution of standardized goods and services, which can be routed in any combination and at any rate to any number of individual customers whose main relationship then is to the general productive mechanism rather than to other people as such. The mechanism requires that human behaviour must be compatible with the requirements of mass production; insofar as possible, individuals must be replaceable and interchangeable parts. Their relationship with each other becomes as exterior and standardized as their relationship to the mass system. Differentiated, unique personalities become as impossible as the differentiated social networks that once sustained them. Quite simply, the energy that once flowed through those networks no longer does; energy now flows in wires and pipes. The effort to satisfy basic material needs that once gave urgency in social relationships and filled them with sustaining material content no longer exists. It has been engineered out of existence in an attempt to fulfil the humanist fantasy of liberation from mundane concerns deemed unworthy of the human intellect, or to realize the fantasy of pastoral felicity and effortless accommodation.

The point is that engineers do not merely design hardware; they design the material framework of society, and thus they design social relations as well. Its effect on social ecology is the greatest ecological impact of engineering. If engineers are to be fully professional, they must take full professional responsibility for their actions. Engineering must recognize and address its social science dimension; the engineer must be a social scientist as well as a designer of equipment and material processes.

The alternative view, still probably typical of most engineers, is that an engineer should merely *react* to situations or requirements that he must accept as given; he should not presume to make judgments except in terms of his technical expertise, which should be as narrowly specialized as possible so that he can be maximally expert at what he does. Social responsibility tends to be regarded in terms of adherence to government regulations. In practice, an engineer who is educated to react will tend to criticize those regulations only on the basis of whether they make his job more difficult. He will feel little professional obligation to evaluate and criticize policy on broader grounds, and certainly he will not feel obligated to take a public stand *as a professional* on questions of resource use and general ecological impact (including social impact) that go beyond the purview of the regulations.

To be sure, technical competence is a *sine qua non* of adequacy in any profession. But if technical competence is all we mean when we say an engineer is professional, then we cannot regard engineering as a profession on the same footing as other learned professions, which are ultimately based on standards of ethics and responsibility that go far beyond definition according to merely technical criteria. We are left with a conception of the engineer as no more than a high-grade technician, a functionary not fully professional — that is, with no resonsibility for his actions beyond their technical adequacy. A glorified mechanic. But someone who is professional in the fullest sense is responsible for taking into account the *ultimate* meaning of his professional actions, and is expected to have the background for doing so. We must assume that a real professional is the ultimate authority for all his own professional acts — then he can't pass the buck, can't define himself as someone who merely reacts to given situations.

Medicine affords the most readily understandable examples of what full professional responsibility entails. We quite rightly demand that physicians base their judgments ultimately on considerations that go beyond the criteria of mere technical feasibility. Good surgery, for example, is far more than surgery alone — consider the ethics of plastic surgery with respect to patients who want to act out fantasies. Nor does the physical and mental welfare of an individual patient provide absolute grounds for judgment. In deciding whether to perform abortions, a physician must bring to bear his philosophy of social welfare, and must base that on a still broader philosophy about the meaning of life.

Medicine should also take into account the effect of social organization on individual welfare — and this, perhaps, should receive the greatest emphasis. Yet this is exactly where medicine has been most remiss in its professional obligation, even though Rudolph Virchow pointed out medicine's social obligation as long ago as 1848 in his analysis of the relationship between poverty and disease. As René Dubos remarks, Virchow's findings imply that *medicine must be a social science.*[6]

On just such grounds I maintain that *truly professional engineering must be a social science.* Medicine provides an excellent comparison, because it is now so obvious that problems of medicine and engineering intersect. Engineering must be a social science, and must also be something of a medical science and a biological science. Evidence that most cancer is due to industrial pollution establishes that beyond doubt. The truly professional engineer must ask whether he has any right to help manufacture a questionable substance or engage in a process which releases questionable wastes. Nor should he assume that a substance is harmless until proven otherwise; the only responsible attitude is to maintain that any new substance, or any unusually large concentration of a previously existing substance, will be harmful, and that we should not manufacture it until it is proven harmless. *Physicians are not the only ones culpable for thalidomide; the engineers who made possible its manufacture are equally to blame.*

In the past we have taken the unwarranted liberty of making radical changes in an environmental system that we did not understand; yet we have long known that random changes in any orderly system are likely to do harm. We are not dealing in vague sentiment here — from a strictly *engineering* point of view, it should appear most reasonable to hold suspect any proposed radical departure from conditions which prevailed at the time when the human species developed its present phylogenetic constitution. We should be particularly wary of biochemical effects.

Such practical questions of systemic integrity can show us how to establish a real separation between engineering and humanism. Unlike ostensive humanism, engineering can assimilate systemic, ecological thinking. To the extent that it does, we will have the nonhumanist, responsible engineering we so badly need. At present, many engineers advocate a "broader" curriculum for engineering students. Naïvely, they suppose this would require a better grounding in the humanist tradition, which panders to their desire for cultural approval. Those of us in engineering education who have been immunized against the self-adulating rhetoric of humanism must disabuse our engineering colleagues before they overload the curriculum with humanist propaganda. Grounding in traditional humanism will merely deceive the students into feeling well-educated, while making them better able to rationalize their acts and fend off real systemic analysis.

To develop an adequate philosophy, engineering does not have to borrow from humanism. The *principles of good systems design* should provide an adequate basis, as long as engineering develops a broader perspective regarding the systems it deals with. Engineers must begin to apply good engineering analysis to issues that in the past they have pretended to ignore. Engineers have produced many unanticipated and undesirable effects not because they have failed to be humanists, but because they have failed to be thoroughgoing as engineers. Adequate grounding in systems science will make obvious the fact that even a concern for medical effects as such is not good enough for good engineering; the social organization which brought about those effects is also part of the problem. This is why I emphasize the *social* aspects of the considerations to which engineering must pay attention.

In the long run, there is little point in merely designing ways to mitigate the deleterious effects of productive operations when such effects are the inevitable result of the principles constituting the organizations involved — principles that engineers have fostered without understanding the implications of what they were doing. Industrial pollution does not continue because people are unaware or unconcerned, but because *people generally have no control over what is going on, even at the local level.* The activities of giant corporations dominate our lives, and as long as we accept the principles on which they operate, we will be helpless before them. Engineers are the ones who have done most to enable the development of industrial giantism, with its attendant transformations of community life, family life, and behavioural values generally, not to mention its virtual destruction of competitive free enterprise. Ironically enough, most engineers tend to view themselves as social conservatives. Yet their activities have made and continue to make inevitable the most radical kind of social change, all because they refused to examine the implications of what they were doing.

Even if engineers as a group would prefer to avoid the responsibility of full professionalism, society cannot allow them such a luxury any longer. What engineers do is too important; the effects of their activities are too profound. The advice of a physician affects one life at a time; the advice of an engineer may determine whether hundreds of people develop cancer ten or twenty years later. We can no longer afford the kind of ignorant specialization that hampered understanding in the past. We must insist on the most rigorous, fully developed, and comprehensive kind of professional standards in engineering, and we must give engineers an education that makes them capable of living up to standards of that kind.

This involves some fundamental re-thinking about the very nature of an engineering curriculum. The education I mean must be integral with technical instruction; it cannot be a mere addition to the technical curriculum. Courses aimed at giving "breadth" tend to be superficial, and to be regarded as extraneous by the students. If we cannot make the change an integral part of engineering instruction, we will continue to graduate engineers who have only the technical skill to perform as narrowly based, irresponsible functionaries having no conception of the larger and more important effects of their activities. Formal training in humanist thought patterns will only mask their basic failure, while encouraging them to adopt the snobbish élitism typical of those who have humanist pretensions.

Once we reject subservience to humanist ideology, we no longer have to fear that a broader engineering curriculum would interfere with the development of technical competence. As I have said, a meaningful approach to ecological (including social) problems would first of all require broader understanding of the most fundamental skill that any engineer must have — the ability to analyze and comprehend the *system* with which he must deal. *Systems analysis* is a basic method of ecological study, which the ecologist tries to make as rigorous, as exact, as quantitative as it can be. *Energetics* is an essential topic for systems analysis in ecology, and along with the study of *material and information flow* it should be a basic topic for an approach to non-humanist engineering. Properly understood, this approach provides a tool for *social* analysis organized in a way clearly relevant to the technical considerations of engineering, couched in a language easily assimilable to the language that engineers already know. An engineer should know how to think about social organization as a *control system.* All engineering is essentially systems engineering of one kind or another; our aim must be to give every engineer a more *generalized* understanding of systems thinking and an ability to apply that thinking to a wider range of systems, making it possible for each engineer to relate his speciality to its broader systemic context in a professionally meaningful way.

Present engineering education is in effect a method for training people to ignore insofar as possible everything that does not bear directly on the immediate technical problem. The main result of this is a tendency to suboptimize partial systems models in terms of very unrealistically defined criteria of "demand" and "need." These simplistic criteria enable planning to go forward without any analysis of systemic context and systemic alternatives. To proceed in such wilful ignorance is unprofessional.

The systemic view, which we could also call the operational or *realistic* view, would enable the engineer to take a much more solid pride in his work. We could even call this view the *conservative* view, for a conservative in the best sense is someone who is process-oriented — that is, "concerned for the on-going inter-relationships and effects of elements within the system on each other." It is also the only conceivable *professional* view. At present, a technically competent engineer is in the position of designing good components for use in a badly designed overall system — a system that we could rapidly re-design for better energy efficiency, without any essentially new technology, and without radical social change.

Engineers are supposed to thrive on challenge, and re-designing our entire system is no more than engineers have already done or enabled others to do. As I have noted, the pervasive changes that have created our present situation, including massive social changes that most engineers probably deplore, are a direct result of technological innovations developed by engineers who lacked an adequate concept of professional responsibility. They evaluated their activities in terms of immediate outputs, thus blocking awareness of what they were really doing. They failed to see that *every output is also an input* that changes systemic organization.[7]

Recent engineering has made everyone more and more dependent on distant sources over which they can have no direct influence. Engineering has designed a situation in which increasing control by centralized bureaucracies has become inevitable. The monstrous federal bureaucracy that fills conservatives with such disgust is a monument to the degree of impact engineers have had; their headlong rush to introduce technical innovation has completely revolutionized our political life, making local self-regulation and independence nearly impossible.

Highway construction provides an excellent example of profoundly revolutionary social engineering. The engineers who design highways at the same time completely re-design the communities along the route, without consulting the inhabitants, who are then easy prey to unscrupulous entrepreneurs who thrive in a destabilized environment. Our community deterioration has been *engineered,* whether deliberately or not. Nothing else short of enemy invasion could have transformed communities so entirely in so short a time.

Highways also *destroy farmland,* both directly and by causing suburban expansion. Agricultural land has disappeared at the rate of a *million acres a year.*[8] Thus highway engineers — we might as well call them highwaymen — without protest, warning, or comment design and put into effect the most criminal resource destruction of all time. Scorched-earth warfare is nothing by comparison. Clearly this loss is *not an agricultural problem, but an engineering problem* — or, rather, any basis for pretending that there is a boundary between the two has entirely disappeared. A good engineer must be conversant with the agricultural problem in order to assess properly the feasibility of a given highway project. Similarly, he must be conversant with the social effects of his design. In any change associated with technological activity, the social problem *is* the engineering problem.

Worse than the highway problem is the general manipulation of society by the industrial commercial bureaucracies, all pretending to offer choice while closing off options. Corporate economics really amounts to a cullusion of private interests in a non-accountable private government controlling nearly every detail of our lives. The limited liability corporation defined as a juridical person is a new kind of *control* system, and as such it is a *suitable topic for engineering analysis.* From a systems point of view, the bad thing about such government is that it is unnatural — that is, it is badly designed and has to be maintained by an excessive energy flow. It is an attempt to deny systemic reality. It is inherently irresponsible, since it is set up precisely to allow those in control to affect others without paying attention to the full responses of those whom they affect. *Thus to inhibit diversity of response from within a system is automatically to increase the energy cost of maintaining the system.*[9] Any engineer should be at least minimally conversant with what systems analysis might have to say about such a problem, and should be ready to contribute to the analysis from his own point of view.

A still more profound effect of relentless technological change has been the fundamental *re-design of basic personality* — i.e. standard behaviour patterns — due to a complete change in the material basis for interpersonal relations and for the expectations that people have. We have engineered individual self-reliance out of existence. People who are cogs in a giant centralized corporate machine are not going to be self-reliant, though they may cling to the fantasy and soothe themselves with rhetoric. But they feel their helplessness, so they become addicts to the drug of consumerism, the endless purchase of endless trivial products. The systemic effects of technological innovation have created a population with an ever-increasing proportion of individuals who demand instant gratification, who have been programmed to "need" constant novelty. Such people represent a new kind of typical personality, incapable of restriction, incapable of permanent relationships, intolerant of life's ordinary demands. They are no longer differentiated individuals whose lives have unique value, but interchangeable components in jobs where replacements are always available, and one is as good as the next. The same inevitably becomes true of personal relationships. One worker is as good as another, one job is as good as another, one spouse is as good as another. This is freedom as designed by our present technology, the creation of engineers who just wanted to do their specialized thing, and let somebody else worry about the consequences.

Whimsical self-indulgence is inevitable in a society of frenetic mobility, where an interchangeable technology creates interchangeable communities full of interchangeable people — the existence of one the function of the other. "Where are the conservative satisfactions of preparing a meal, working up a sweat digging in the garden, doggedly finishing shovelling the driveway? What are we being conditioned to need and feel?"[7] The flat sameness of mental life reflects the surroundings. Flat and yet full of violent random motion, people rushing to and fro. A perfect analog of increasing thermal motion due to increasing energy flow — more and more violent, rapid, and interchangeably identical. "Due to the impact of technological development . . . . the cooperation and communication that used to accompany life's chores is being built out of our social systems . . . . The family has become atomized as a result of the impact of technological devices, conveniences and values on home life."[7] Indeed, the engineer who provides such devices or provides the materials and energy for them is a *social* engineer without parallel.

In fact, we do not even need subtle analysis to prove that our system tends to maximize energy and materials consumption, nor do we need to argue about whether such a tendency is indefinitely sustainable. We need only ask how to decide on what energy and resource and organizational criteria we must use to indicate a consumption level that *is* sustainable, and how to apply those criteria. How should we go about designing a system that will stay at a sustainable level? This is clearly the engineering and social question for our times, and I should not have to ask it — any professionally responsible engineer should have thought of it ten years ago. Unfortunately, engineering has failed to develop real professional responsibility because, as I suggested at the outset, engineering has been dominated by humanist values, which are inherently antisystemic and, therefore, inherently irresponsible. The humanist dream of "progress" to which engineers have devoted themselves is a manifestation of humanism's fantasy concerning what it regards as human freedom, dignity, and power. Manipulation of the world both exhibits these things and proves that such manipulation is justified — if you are free, you have a right to act freely. There is a built-in tendency, therefore, to identify "progress" with anything that increases the amount of energy and material that people control.

When the inevitable ill results of such behaviour become too obvious to ignore, those non-engineers consciously devoted to ostensive humanism pat themselves on the back for being sensitive enough to notice the problem, while they chide engineers for creating it. The engineers then are supposed to take care of it. Non-engineering humanists are proud of themselves for having well-articulated noble sentiments, and they feel that they have fulfilled their obligation when they voice these sentiments. These non-engineers assume, however, that the solution to a problem will always allow them to retain unlimited control over energy and materials, and they humanely insist that all people should have such benefits. Thus the key to humanism — that is, to "progress" — is a belief that we can have our cake and eat it, too — that we can somehow ignore the second law of thermodynamics. That is the belief embodied in our society's basic design assumption that energy and materials use should increase every year — that we should attempt to maintain unlimited growth. The fact that engineers have accepted such a design assumption argues that engineers have been trained to be humanists first and engineers second.

Engineers by themselves cannot solve our problem, but if engineers will not take full professional responsibility for what they do, we will all continue to be helpless. *Engineering education* may be the key to the modern dilemma. Those who have addressed this problem have usually suggested, in effect, that engineers need more humanist propaganda. But engineers are already unconscious humanists, much to our detriment. The cure is not to make them conscious humanists, but to make them able to apply systemically and ecologically valid engineering analysis to the humanist assumptions that have dominated them and the rest of us. *Engineers must become responsible for the social meaning of their acts.* Only then will they truly have professional integrity. Only then will they truly benefit society.

References

1. J.B. Bury, *The Idea of Progress: An Inquiry Into Its Growth and Origin,* New York, Dover 1955.
2. David Ehrenfield, *The Arrogance of Humanism,* New York, Oxford University Press 1978.
3. Joseph Meeker, *The Comedy of Survival; Studies in Litary Ecology,* New York, Scribners 1974.
4. C.S. Lewis, *The Abolition of Man,* New York MacMillan 1965. See also Meeker, *The Spheres of Life: An Introduction to World Ecology,* New York, Scribners, 1975.
5. Edward Goldsmith, *The Stable Society,* Wadebridge Ecological Press, 1978.
6. Rene Dubos, *Mirage of Health,* New York, Doubleday 1959.
7. J.C. Mathes and Donald H. Gray, "The Engineer as a Social Radical" *The Ecologist,* May 1975.
8. Paul Sears, The Inexorable Problem of Space, *The Subversive Science; Essays Towards an Ecology of Man,* ed. Paul Shepard and Daniel McKinley, Boston, Houghton Mifflin 1969.
9. Ramon Margalef, *Perspectives in Ecological Theory,* University of Chicago Press, 1968.

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Co-publication with the British Museum (Natural History)

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The Death of Joe Harding


Peter de Ru

It is afternoon when we arrive at the small town of Paducah, Kentucky. Here is located one of America's three uranium enrichment plants, with approximately 2,400 employees. An increasing amount of information has lately been coming from here on mysterious diseases and unusually high mortality in cancer, probably as a result of long-time work with uranium and with the toxic chemicals used in enrichment.

This evening we'll meet Joe T. Harding, 58, who for years has had grave physical troubles after working at the plant. But the company has refused him, as so many others, any compensation.

Joe has just returned from seven weeks at a hospital in Memphis. He no longer consults doctors in his hometown Paducah.

"I did that for many years," says Joe. "But you see, here the doctors don't dare tell you the truth and sometimes they don't even dare to examine you properly. They tell you one thing verbally, at their office — 'that's nothing normal, it's probably radiation damage' — but when you ask them to put it on paper they never do it. Or they write that they don't know.

"They are afraid of being sued by the company. Union Carbide dominates everything round here. That's also why people here don't like to talk about you getting diseases or dying from working at the plant. Almost everybody has someone in the family, or a relative or a friend working there. And you don't want to risk their jobs."

Joe sits in his wheel-chair. It is difficult for him to breathe and he talks slowly but clearly and distinctly. His descriptions are exact when telling us about his work at the plant, his diseases and physical sufferings — and his eight year long struggle against the Union Carbide Corporation.

"You have to say when you need to rest," I say. "We have plenty of time. All of Saturday and Sunday, at least. And even more, if we need. You promise to say?"

Joe nods, and starts his story.

In October 1952, when Joe was 31 years old, he started working for Union Carbide in Paducah. The plant was all new and very secret. During the first three months Joe went through the company's training school.

"They really brainwashed you, it's the only word that fits. They made us believe that everything they said about security at the plant was true, were pure facts. Everything was so safe, so riskless. They promised us that we would never be exposed to any more radiation than a person who wears a luminous dial wrist watch.

"Today we know the truth about those promises. I can feel it in my body, and I know what has happened to many of my fellow-workers."

For many years Joe has systematically collected all information he has got hold of on uranium, radiation and nuclear power. And for just as long he has also been making lists of dead and sick work-mates.

Of the about 200 healthy young men who started working with enrichment at the same time as Joe, approximately 50 have, according to his estimate, died from leukaemia, cancer or some unidentified ailment probably related to radiation or toxic chemicals. A further ten are, like Joe, severely ill.

"Inside the plant everything was secret. The different buildings were called only by numbers and all the gases and chemicals we were handling also had code-names. Often we didn't know at all what we were working with, what we got on our hands and in our lungs.

"The uranium hexafluoride was for instance only called PG, process gas. We were told to keep quiet about our jobs, and informed that any one of our work-mates could be a security man. So you didn't talk very much about the job, least of all about problems. You had a family depending on you, and the pay was fairly good, as the plant ran 24 hours a day, 7 days a week.

"For 12 and a half of my slightly more than 18 years at the plant I was working in the areas where radiation was at its highest. All these years I breathed uranium hexafluoride so thick that you could see the haze in the air when looking at the ceiling light, and you could taste it coated on your teeth and in your throat and lungs. After a couple of hours' work the uranium dust on the floor was so thick that you could see your tracks when walking around.

"There were leaks almost daily. Gas or liquid was leaking almost constantly from some part of the many miles of tube-systems in the plant. Sometimes the leaks were so serious that they had to leave certain areas for a couple of hours. The only protective clothing they wore were white coveralls, yellow leather shoes, gloves, a white cotton skull cap and — sometimes — a dust-foe respirator of the same simple type used by spray painters and sand blasters. A respirator that will only catch some of the solid particles.

"There was no particular lunch-room or lunch-hour. You just sat down somewhere, blew away the uranium dust and had your lunch packet. When I think about how all these years we actually had uranium for lunch it just terrifies me.

"We wore film badges that were supposed to show how much radiation you had been exposed to. They were collected about once a month and sent to the laboratory in Oak Ridge, Tennessee, for analysis. But we never heard from them, so one time, three or more of us laid our film badges on top of a smoking chuck of uranium for eight hours. Still we didn't hear from them.

"About every ten days we had to give a urine sample that should show if we had got too much uranium in our bodies. But even though we knew the leaks were almost routine, we never heard from the laboratory. The same three or more operators then dropped a chunk of smoking uranium straight into our urine samples. But still we never heard from them."

Joe thinks the company kept quiet because the quantities of uranium in the urine samples probably quite often were much higher than permitted, as well as the radiation doses shown by the film badges. Perhaps the company had two sets of records and files on the most exposed workers — one official file with fine data and one that showed the real ones.

Or they just 'improved' the real amounts registered. These statements are confirmed to us some days later by several of Joe's former fellow-workers.

"In the same way cheating was done with the radiation surveys of the Product Withdrawal Room and of the cylinders with enriched uranium that should be shipped away. We zeroed the meters in the places where the surveys should be made! They of course showed nothing, if you didn't happen to hit a particularly 'hot' spot. All the background radiation disappeared at the zeroing. All that time we didn't understand that, however."

The workers were also encouraged to falsify and 'clean' the results of the radiation surveys, should they, in spite of everything, be too high. Joe tells how he reacted the first time it happened to him:

"I was on the mid-night shift when a cylinder I surveyed showed to be too hot to hold the levels for shipment. I called over to the supervisor in the control room and said, 'Hey buddy, I've a cylinder here in No. 2 position that we can't ship, it's too hot'.

"But the supervisor just said, 'What do you mean we can't ship it? See if you can't get me a better reading'.

"I hadn't worked there for so long and thought that maybe I had done something wrong, so I read it again with two or three different meters. Same result. I called him back and said, 'I just can't ship it, it's just too hot'.

"He just said, 'Listen, we've already got this cylinder reported to go on this truck. So let's get a real good reading and get it shipped'.

"He's the boss and you start to realize that he actually means just what he said. So you just say to hell with the meter, you put down an acceptable reading and you ship it. When that has happened a couple of times, and you've heard the others it dawns on you that everybody is doing the same thing. Then you understand why the radiation meters sit in the corner and get cobwebs on them.

"Everybody thought the same, I guess, 'Why make trouble, I'd just risk losing my job'. It was the same with the leaks and releases that got outside the plant, why fight it? And if we had tanks with contaminated liquid or gases that had to be got rid of, we'd just wait till a dark night and shoot it right up the stack."

The workers repairing the leaks were particularly exposed. To protect themselves from the heat they used blankets made of asbestos. So besides uranium and toxic chemicals they often also inhaled great amounts of asbestos fibres.

According to Joe Harding and several of his fellow-workers, working conditions at the plant during the 50s and 60s were thus outright scandalous and perilous. But not only in the light of what we know today about the effects of low-level radiation or toxic chemicals. Because Union Carbide as well as the Atomic Energy Commission (AEC, later Department of Energy) knew quite a lot even by then. The very same AEC that kept secret the risks with the bomb tests in Nevada also concealed the risks at the enrichment plants.

The enrichment facilities were militarily important and The Cold War was at its worst. From Paducah the uranium was transported to the plants in Oak Ridge, Tennessee, and Portsmouth, Ohio, where it was further enriched, both for nuclear fuel and for high-grade uranium for the production of nuclear weapons. And neither Union Carbide nor Goodyear, which runs the plant in Portsmouth, wanted to lose their profitable licences.

Even today working conditions seem not to have improved very much. In Portsmouth, the workers recently carried out a seven month long strike, protesting among other things against deficient safety. And in Paducah workers continue to get cancer and mysterious ailments. But the Union Carbide Corporation persistently denies that any one of their workers has ever been hurt by radiation or chemicals. No medical study of elderly workers has been done.

"It took me many, many years till I began to realize how terrible our working conditions were. Not even when I myself was getting ill did I want to understand".

In the middle of 1953, after only six months at the plant, Joe started getting open sores on his legs. They later spread to almost all parts of his body. For three years he was treated with salves and strong antibiotics by the company doctor, who could not explain what kind of sores they were.

During the following years he was treated at various hospitals and by several distinguished skin specialists. But the sores didn't heal, and one dermatologist told Joe in confidence:

"There's no point you coming here, I'm just wasting your time, these are no usual sores, there's nothing I can do. It's probably radiation damage."

"But I just laughed at him. I still was so blind, so brainwashed. Radiation damage, hell no!

"In 1954 I began getting stomach troubles for the first time in my life. I had pains and often vomited. I knew it wasn't an ulcer, because it didn't get better with that treatment. But I kept tough and for several years tried to hide the fact that there was something wrong with me.

"After five years of stomach troubles and having lost many pounds I at last went to a doctor. He said it was serious, and that it probably was radiation damage. I still didn't believe it and kept working as usual.

"Two years later, in 1961, 'I just couldn't stand it any longer. I had terrible pains and had gone from 175 to 125 pounds since 1954. I went back to the same physician who had examined me last. This time I didn't laugh when he said it was radiation damage and that I'd better get myself a good surgeon pretty fast. I was operated on the same year, they removed 95 per cent of my stomach and parts of my intestines. After the operation I weighed 112 pounds."

No real diagnosis was ever made on Joe's stomach troubles. It wasn't an ulcer, but radiation damage was not convenient to write. For several years the removed parts of his stomach were preserved in formaldehyde at the hospital — so unusual were the observable changes of the tissue.

The stomach operation changed Joe's life completely. He now had to eat small amounts 6 to 8 times a day, take several kinds of vitamin pills and food supplement and give himself a shot of B12 every week. But he kept working for Union Carbide.

"Only now did the brainwashing begin to crumble and disappear, so strong had it been, and was for every one who worked at the plant. I was getting unbrainwashed and suspicious", Joe says.

In 1965 three growths were removed from Joe's lower lips.

"They made no diagnosis, just said there was something wrong but that they didn't know what."

Three years later it was discovered that Joe had pneumonia on one side. Since then he's had pneumonia almost constantly, 11 times all together.

The physicians who examined his lungs said that they looked 'strange', and that the insides were covered with 'unusual' tiny pits or holes. Even his pneumonia was of an unusual kind, they said.

"But **what** it was, they didn't know", says Joe . "They just said that 'This is real different. We haven't seen anything like it before'."

In 1970 nail-like growths began developing from the finger-print side of Joe's fingers and thumbs. Somewhat later they started growing also from his knuckles and finger joints.

"Now I have fingernails growing even from my wrists, elbows and shoulders," Joe says. "And something like toenails are growing from my ankles and knee caps. Various doctors have said it is mutations, cell changes caused by radiation.

"Two years ago I also started having this trembling, shaking or jerking you notice in my body. One doctor I have consulted thinks it is damage to my central nervous system from radiation."

During the recent stay at the hospital in Memphis it was discovered that Joe had large areas, hitherto unknown, with cancer tissue in the lower part of his abdomen, and tumours in the inside of his back.

In 1954 Joe had injured one of his knees when falling from a truck on the plant area. That was the only injury for which the company took responsibility — somebody had been negligent with the safety devices.

In the course of the years his knee injury deteriorated, and in 1968 Joe went through an operation that left him with a permanently crippled knee. He was transferred to the control room, a job that didn't strain his knee so much.

— But Union Carbide wanted to get rid of me entirely. They pretty well knew what other physical troubles I had and why. They were afraid it should become too obvious that my troubles were related to my work with the uranium. So they took my knee problems as a pretext for terminating me.

— I didn't want to be terminated, I managed my job well in the control room. I knew exactly what had to be done when the fellows out in the plant called me over about different problems, I had worked out there myself for many years."

Only a couple of hours have passed since we left him, late yesterday evening. Joe had been very faint and weak but so alive and intense when telling us about his work at the uranium enrichment plant here in Paducah, in the borderlands between the North and the South.

Today we were to have continued our conversations, our interview. Joe had prepared himself several days to give us as much background and facts as possible. In the middle of the week an investigation team would come from the Department of Energy. They were to inspect the plant, interview Joe and many of his fellow-workers. And in April Joe was to testify at the Radiation Victims' Hearings in Washington. Today he is dead.

Fully 18 years' work with uranium have cost him his life. The responsibility rests heavily, principally on Union Carbide which runs the plant. But also on the US Government, which owns it. And on Sweden. Because here the uranium used in Swedish reactors is also enriched.

Outside, there is a snowstorm. The ice-cold wind blows straight through doors and windows. Tomorrow, Sunday, we'll see Joe a last time. The funeral is on Monday.

But we are many who will carry Joe's cause onward. The responsibility can never be buried.

Pierre Frühling

The Shrinking American Acre

Private property rights, a tradition that the American people have come to expect, were attacked recently in a release from the National Agricultural Lands Study. As prime agricultural land continues to be lost to urbanisation, at an alarming rate of four square miles each day, the conditions which allow this land use transfer are being questioned.

Bob Bergland, Secretary of Agriculture, states, "The U.S. is losing one million acres of the world's best and flattest agricultural land each year to urban sprawl. Before this century is out, we will pave over an area the size of Indiana, I don't know where it is going to stop, but stop it must. Continual destruction of cropland is wanton squandering of an irreplaceable resource that invites future tragedy not only nationally, but on a global scale."

The National Agricultural Lands Study under the co-chairmanship of the US Secretary of Agriculture and the Chairman of the Council on Environmental Quality was launched in June of last year and is due to be completed by the first of January, 1981 for submission to the President. Twelve Federal agencies are participating in the study, State and local governments, individual land holders and public interest groups are involved. "They are examining the availability of the nation's agricultural lands, the extent and causes of the land's conversion to other uses, and the various ways it might be retained for agriculture."

Perhaps, the most useful component of the study is the farm land inventory which began in 1975 by the U.S. Department of Agriculture's Soil Conservation Service. To date, maps which identify "prime, unique and other important farm lands", have been published for ten states. When completed these maps should provide essential information for local government and conservation groups alike. Barry Flamm, director of USDA's Office of Environmental

Quality, states "SCS is counting prime acres, so that local communities can make every acre count."

From the information already available it's clear that the loss of agricultural land is a serious problem that is in no way diminishing. Each year one million acres of prime land and two million acres of lesser quality but still productive land is lost. Washington correspondent, George Anthan of *The Des Moires Register* made some interesting predictions in a series of articles entitled "Vanishing Acres".

If current trends continue by the year 2000:

- All food produced in the U.S. will be consumed there. The hungry people of other nations will be on their own for food supplies.
- Consumer food prices will be pushed sharply upwards. This will be 'real' price increase, not just 'inflation' increase.
- Food exports no longer will be available to help offset massive trade deficits, such as payments for foreign oil. This will almost certainly have a negative effect on the national economy.

It is clear that this problem is as serious or more serious than the present oil crisis. We can live without oil but we cannot live without the food that can only be produced on our agricultural land. If nothing else, the National Agricultural Lands Study will document the course of the destruction. Whether or not it will change current trends remains to be seen.

Comments and requests for additional information should be directed to The Executive Director, National Agricultural Lands Study, 722 Jackson Place, N.W. Washington DC 20006, USA.

Margi Allan

Too Late to Save the Border Ranges?

Russ Maslew

The State of New South Wales used to have about 730,000 hectares of rainforest but now possesses only about 81,000. Much of this remainder has been logged for timber leaving a mixed growth of scrub and weeds. The only substantial unspoilt area remaining is the Border Ranges. This includes the largest tracts of prime virgin subtropical rainforest left in Australia and possibly in the world.

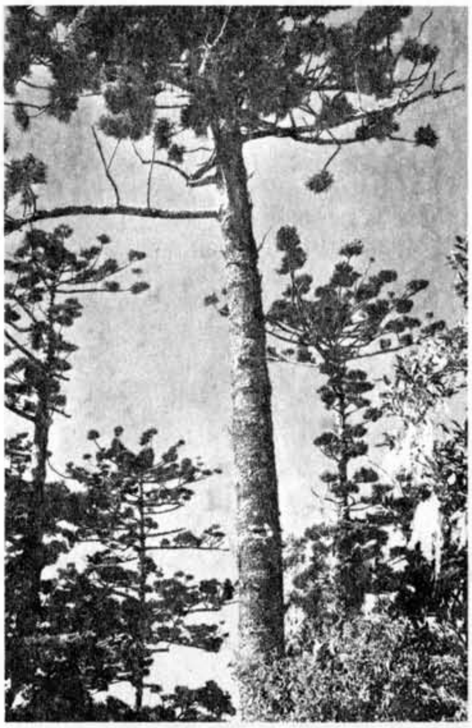
Much of Australian forest consists of eucalypts which are hardy trees that resist heat and drought and can recover from ground fires and logging. Sunlight freely penetrates the tree canopies and the ground flora and fauna is adapted to intense light. By contrast, rainforest trees need to maximise their exposure to sunlight because of high rainfall. They do this by forming a dense canopy some 25 to 30 metres above the ground. This protection from sun, winds and temperature extremes produces underneath a characteristic flora and fauna of great variety and richness. The trees forming the canopy also comprise a great variety of species, two of the largest being the hoop pine and the strangler fig. Others include various palms and, in the higher cooler regions, the antarctic beech. The trunks, usually bare of branches below the canopy, and often supported near the base by flanged buttresses, produce an impression similar to that of a gothic cathedral.

The Border Ranges area is the broken mountainous land along and adjoining the eastern section of the border between New South Wales and Queensland. On the Queensland side is the Lamington National Park established in 1915. On the NSW side are the three state forests of Wiangerie, Roseberry and Mount Lindesay, of total area about 33,000 hectares. Also in this region is Grady's Creek Flora Reserve of 1,500 hectares. The whole area is part of the MacPherson-Macleay Overlap of eastern Australia where the tropic and temperate zones overlap. Apart from the rainforest flora and fauna which include species unique to this area, it is of particular biological interest in studies of plant evolution, being one of the most important plant migration routes that may be traced between the northern hemisphere and sub-antarctic regions. Its climate is thought to be similar to that of the uplands of the

Gondwanaland continent which may have been the birthplace of the flowering plants in Cretaceous times.

Apart from the scientific value of the Border Ranges, their scenery is spectacular with magnificent cliffs, plateaux and peaks which rise to heights of over 1,200 metres. Due to the high rainfall, many major streams originate in this region. Early aboriginal sites also abound. They thus possess value both as a wilderness and as a recreation area, two ideas which are joined in the National Park concept but which are to some extent mutually exclusive. Overuse of wilderness areas for recreation can impoverish or destroy them. Wilderness and the flora and fauna it contains forms an important part of the heritage to which future generations are entitled. The value of wilderness is difficult or impossible to give in money terms, and hence when it conflicts with purely economic values planners and political decision makers tend to think these non-economic values are less important. Committed citizens are needed to make them think otherwise. The Border Ranges contain species of trees with economically valuable timber and hence provide profit for the sawmilling industry and employment for local inhabitants. These timber interests have been supported by the NSW Forestry Commission in fulfilment of its charter, the Forestry Act, to 'encourage the use of timber'. They have been opposed by the NSW National Parks and Wildlife Service and by conservation groups such as the Australian Conservation Foundation, the Colong Committee, the Border Ranges Preservation Society and the Byron Bay Flora and Fauna Association. These groups have pressed for a Border Ranges National Park, and have pointed out that the timber workers gain a somewhat dangerous and impermanent employment in the exploitation of ever decreasing timber resources. Alternative employment could possibly be found in national park management and in dealing with the tourists that would be attracted to the area. In spite of opposition from the sawmillers, Grady's Creek Flora Reserve was established in 1973, but the Forestry Commission would not even consider the idea of a national park. The conservationists have also pointed out that since the Forestry Commission appears to run at a cash deficit, the taxpayers of NSW are subsidising the sawmillers, so that the taxpayers are, in effect, paying to have the rainforests logged.

It is not possible to log about a third of the state forests due to the steepness of the terrain, but the Forestry Commission policy of selective logging with the retention of 50 per cent of the canopy has continued elsewhere. This practice has attracted much criticism from scientists outside the Forestry Commission. Due to the destruction caused by felling and removing the trees, the nominal 50 per cent is in practice more like 40 per cent. Even the Forestry Commission's own rainforest authority G. N. Baur admits that 'managed rainforest will be impoverished shadows of the virgin primaeval stands'. Renewal is likely to take centuries rather than decades. The conflict between short term local interests represented by the sawmillers and the Forestry Commission and the long term national interests represented by the conservationists eventually led to a State Interdepartmental Committee Report in September 1977 on seven possible management options for the Border Ranges. This was passed to the State Pollution Control Commission in February 1978 who invited written submissions from interested persons. The NSW Government gave their decision in May 1978. Less than a quarter of the area occupied by the three state forests will become national park, 7,600 hectares out of 33,000 hectares. Biologists consider that this area is far too small to constitute a self perpetuating biological unit. Logging will continue in the remainder, where access permits, with a policy of 50 per cent canopy retention. Biologists consider that this will lead to long term damage to the rainforest ecosystem. The time required for closure of the canopy is unknown but may take centuries. In addition, Grady's Creek, a large flora reserve of 1,500 hectares will now be logged to 50 per cent canopy retention.



Henry Gold

Hoop pines on Levers Plateau

Hardly surprisingly, Australian conservationists regard the NSW Government decision as a victory for the sawmilling interests and therefore appeal to world opinion to help them preserve this region of unique scientific interest as part of the world's heritage. Letters may be sent to the NSW Premier, Mr Neville Wran, at Parliament House, Sydney, NSW, to ask for a major extension to the National Park and a moratorium on logging in the Border Ranges.

R.W. Howes

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Man-made Famines

THE GEOGRAPHY OF FAMINE, by William A. Dando. Arnold, London, 1980. £12.50.

This is an extremely interesting book. Its overt goal is to show that, in general, famines, rather than be 'acts of god,' as many people assume, are, in fact, man-made.

"Natural factors cause crop failures" he writes "but humans cause famines". The book is admirably documented, the author having actually gone to the trouble to develop a computer data bank on the subject which now contains information from over 8,000 famines that have occurred in the last 6,000 years.

His study reveals that famine was relatively unknown among hunter-gatherers. It is only when man started to lead a sedentary existence and indulged in large-scale agriculture that famines began to occur. "Famine is a characteristic of crop and livestock agriculture" he writes "and was not a facet of pre-agricultural systems."

What is more, famines have become more numerous with the "march of progress." In India, for instance, the frequency of famines dramatically increased during the British Raj. Thus there have probably been 90 famines in that country in the last 2,500 years, but 66 per cent occurred since 1701.

In the pre-European era, there was about one famine every 40 years, but as Dando tells us, "famine frequency increased in the period of the British conquest, 1707-1815 to one famine every seven years." What is even more striking however "than the increase in famine frequency and magnitude of famine deaths, was the change in the nature of famine, from a shortage of food in pre-European India to the lack of the ability to buy food in British India."

This ties in with the conclusion of B Bhatia's book *Famines in India* in which famine was equated with poverty. The people were impoverished partly by the land taxes to raise money for the financing of the Indian army, partly by the workings of the market system itself which made grain available at a price they could not afford.

Dando's survey on famines in Russian history yield the same results. "In essence" he writes . . . "all of the famines that have occurred in Russia from 971 to 1970 can be predominantly attributed to human factors."

What of future famines? According to Dando these can only become more frequent and more serious. Third World countries are being forced to export more and more of their food, the increasing use of high yielding crops associated with the introduction of the Green Revolution must also increase vulnerability to agriculture. "A world crop by crop analysis" he writes "reveals an extremely risky dependence on a narrow gene base, more and more people are being fed on fewer and fewer crops and these are becoming increasingly uniform, genetically, and increasingly vulnerable to plant disease epidemics."

The chemicalisation of agriculture is also likely to lead to famine. "Man by assuming that the soil is lifeless may change its structure, processes and functions." There is a risk of man killing life supporting plant matrix soil."

As a result of these and similar developments the famines of the future are likely to be very much larger-scale events. "In the past," as he points out, "they were short term events, confined to restricted geographical areas and taking the lives of limited numbers of people." Surprisingly enough, there have been no nationwide famines even in India, China or the USSR, however "future famines will last for extended periods of time, cover broad geographical areas, encompassing many nations and will involve tens of millions."

Edward Goldsmith

Acting in the Dark

THE SOCIAL CONTROL OF TECHNOLOGY by David Collingridge. Frances Pinter, London. £12.75.

In 1956 Sir George Stapledon, the famous agricultural scientist, said, 'What chiefly matters is our attitude towards ignorance. This is a huge subject and one demanding several chairs of research devoted to it, but I doubt if it yet enters into the syllabus of a single university or technical college.' He felt that the future would depend on 'the manner in which we contrive to regulate and hold in check the incidence of such new ignorance as will be continuously laid open and rendered operative by each and all of the increments of new knowledge.' Stapledon's Law of Operative Ignorance was that for every application of new knowledge forces were set in motion of which we were ignorant and which might do more harm than the new knowledge did good.

One university at least is now tackling this urgent and neglected subject: the Technology Policy Unit of Aston University by sponsoring work of the calibre of *The Social Control of Technology* is taking steps toward furthering Stapledon's ideal. David Collingridge is a double first in the sense that he has studied both science and philosophy and he applies insights derived from both to solving the problem of how we should reach policy decisions when ignorant of the outcome of the decisions: since experts invariably disagree all major policy decisions today are taken in ignorance: as in the examples of lead in petrol, nuclear power, the Green Revolution: all cases studied by Collingridge to illustrate his suggestions as to how policy makers should think confronted by their own fallibility. He exposes how irrationally they have behaved so far, including committing us to the nuclear arms race as a consequence of not understanding the implications of dropping the first atomic bomb. There is a first rate analysis of the Manhattan Project in terms of the political decisions involved.

Collingridge argues that mistakes

arise from an incorrect idea of science: namely that facts studied scientifically can only have one interpretation, whereas in practice they invariably have several interpretations, or at least consensus takes a very long time to be reached. Decision makers expect some absolute advice: this is right, that is wrong: such advice is hardly ever available where complex modern issues are concerned. If we imagine that it is, then we treat an on-going process as if it were a final event. In addition to that we create the psychological situation in which those who do not accept the interpretation which we favour must be corrupt, stupid, biased and so forth, whereas experts on both sides in most disputes may reasonably have their own interpretation of the facts, leading them to differ even when they share the same background values — such as that lead in petrol should be removed if proved hazardous to health. That bias and falsehood can be present is not denied, but it is the duty of legislators to lay down conditions of inquiry that ensure that the evidence is open to the public scrutiny and without unfair constraints and secrecy. The old notion of the impartial expert with infallible objective knowledge is once and for all cast overboard. The expert is fallible and human; he has the prejudices of his vocation and his research; he backs his interpretation against those of other experts. He takes a committed part. The decision makers must recognise this and make allowances for it in their rules of procedure.

What are these rules? Anything I can say in a review must oversimplify the scrupulous and closely argued conclusions of *The Social Control of Technology*.

The general conclusions however would satisfy an ecologist since they are that: decisions should not be of the dogmatic kind based upon the assumption that there is only one best way; decisions should allow for alternatives and diversity in case the chosen option turns out to have some dangerous or disrupting consequences, as is likely given the inevitable ignorance of all the factors involved in applying technology to society. If, then, every decision must be of a provisional kind, the organisation of its application should be such that it is not too costly to change course: flexibility is the great virtue. Generally small units have this flexibility rather than large units. On the other hand large units benefit from economies of scale, which is why we have allowed them to become entrenched, often with consequences that far exceed in cost what they originally saved, when the theory on which they were based is found to be in error: a result of not monitoring their effects in time. Usually it is better to trade-off the higher running costs of small units against the enormous costs of an entrenched mistake — as with Concorde and now, probably, the advanced gas cooled reactors.

All the time I was reading this book I was aware of how its conclusions can be applied to the control of the countryside. I once wrote a study of the general draining of the Fens as a massive mistake now beyond recall. The people who made the decisions were ignorant of the effects of draining fen land. Those who now intend to drain the Somerset Levels cannot plead ignorance but no proper social organisation exists that compels them to discuss the issues in public. Our countryside is being devastated today because no effective precautions were taken to monitor the social and aesthetic effects of applying modern technology to the land. The present government has even reduced what little monitoring there is.

If the lessons of this book were thoroughly digested by society, our worst errors would be avoided in the future. It is therefore a very important book indeed. I predict that we shall hear more of David Collingridge and the Technical Policy Unit. I hope that he will remember that he is not only writing for academics and simplify his style, as I'm sure he can since he knows what he is talking about. I also hope we shall have from him before long a cheaper and more popular book on this theme. The social control of technology requires society as well as technologists to understand the principles of decision making.

Robert Waller

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CONFERENCES

First Assembly: THE FOURTH WORLD — for small nations, small communities and the human spirit. London July 1981. Further information from John Papworth, Assembly Convenor, 24 Abercorn Place, London NW8, England. Tel. 01-286-4366.

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