

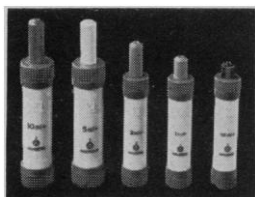
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LETTERS

Use of Energy

In his editorial, "Continuing increase in use of energy" (21 May, p. 795), Abelson notes five fundamental problems of our present economic system. The system will have to be redesigned to solve these problems if the aims of his editorial are to be realized.

1) Present incentives (profits, corporate growth, and so forth) operate to encourage high consumption, such as product proliferation, product inflation, rapid obsolescence, high turnover, and high waste. The incentives are weak that operate to satisfy needs with maximum efficiency, minimum inputs of labor and materials, and lowest real or long-term cost.

2) Progress in the direction indicated implies institutional restructuring that would displace many people from their present jobs. Can the system adapt smoothly without widespread disruption, maldistribution, unemployment, and economic depression?

3) How can the system handle the situations where the logic of "Tragedy of the Commons" or "tyranny of small decisions" operates? For example, my private decision to turn off unnecessary lights in my house is hardly influenced at all by the thought of the few cents saved. Yet the actions of millions of people thinking that way add up to a ponderable result. Electricity would have to cost much more to make me act differently; it is likely to cost less. And if it is deliberately made to cost much more, who gains? Similarly, when I decide to drive my car to work or hitch a ride with a friend, I do not take into account that my decision is helping to destroy a public transit system or a railroad that some other day I may want to use. It is widely believed that the system of private choice in the marketplace handles all these situations. The fact is that in many of them it breaks down. What kind of redesign will fix it?

4) The market system does not arrive at the best allocations if the relative prices of goods do not reflect their total real costs. Furthermore, study of many pollution cases shows that even a proportional distribution of the "total social cost" into the selling price or an industry's taxes will not accomplish the desired result, because of the presence of decision-making processes of the type previously discussed.

5) The system excessively discounts

the future. This problem is implicit in Abelson's concern about rapid consumption "at ridiculously low prices" of nonrenewable resources. The "discounted present value" criterion for the use of capital resources, at high interest rates, leads to some patently bad decisions, which can impose escalating costs of another kind on our descendants.

R. W. JACKSON

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A switch to low-sulfur natural gas and fuel oil would have implications for agriculture, since a considerable amount of the sulfur needed by crops comes from atmospheric sources. Soil and plant analyses and field experiments in many areas of the world show that sulfur is a limiting nutrient element in crop production, particularly in non-industrialized regions. There has also been a significant decrease in the sulfur content of fertilizers in recent years (1). Direct absorption of atmospheric sulfur dioxide by crops and plants has contributed significantly to the sulfur nutrition of crops.

In cleaning up the air, due allowances will need to be made for the removal of one unsought bonus of air pollution—the millions of tons of sulfur that are released annually into the atmosphere.

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Reference

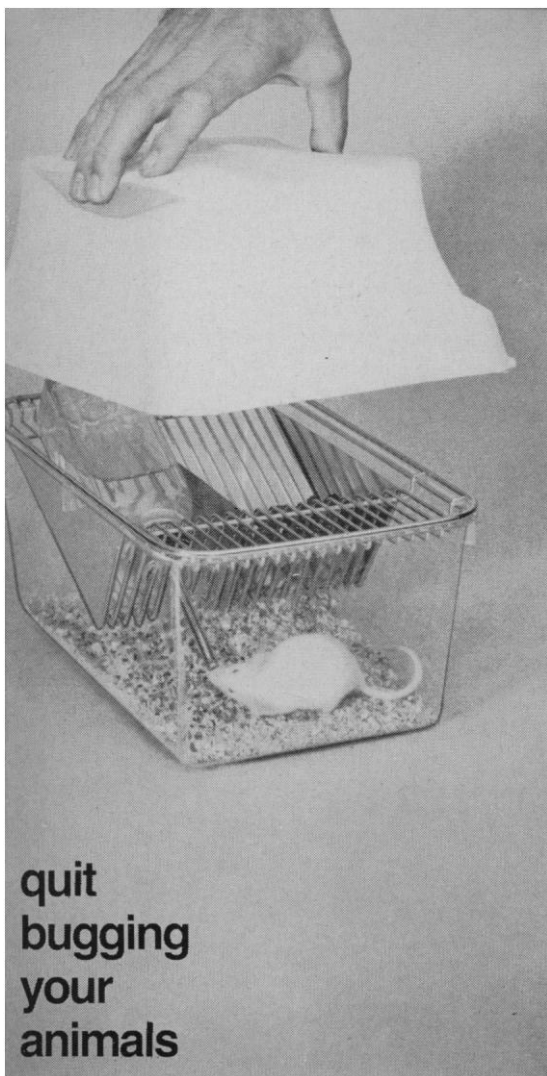
1. *Sulfur in Agriculture* (Proceedings of a symposium at Johnstown Castle, Johnstown Castle Agricultural College, Wexford, Ireland, 1970).

Ecology

"There are no such people as ecologists. I don't know what ecology is. Ecology is a word; it isn't a science. It is the sum of all the sciences that must be brought to bear on the totality of the biosphere, so I am told.

"When I looked around at ecology a few years ago, the best that the ecologist, so-called, could hope to do was to understand the processes in what he called the 'terrarium' . . . or perhaps a goldfish bowl . . . and suddenly they wish to make extrapolations to Lake Erie or the totality of the grass lands of the United States."

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with a reference to "hortatory hyperbole" on the part of environmentalists, was the assurance that our present concern stems from esthetic offense rather than evidence of physical or biological danger.

These statements might pass without notice had they not been delivered to an intelligent lay audience by a distinguished scientist in a position of unusual influence. Since I respect his professional achievements and cherish his friendship, I take the liberty of being no more specific than this. My concern is not personal, but with ideas. Polemics is not my dish.

To begin with, and leaving aside the relegation of more than 4000 members of the Ecological Society of America to nonperson status, the speaker underestimates a respectable amount of serious study of inland waters. Likewise he ignores many years of productive work on grasslands.

He also minimizes the value of esthetic judgments as clues to environmental disturbance, which they certainly are. Even in the field of human pathology, Osler was noted for his diagnostic skill in the use of external appearance—backed, of course by a prodigious amount of clinical experience, comparable to the field and laboratory training of the ecologist.

Obviously there exists a good deal of misunderstanding as to the nature of ecology. Many factors contribute to this. Although ecology became inevitable with Darwin's evidence of the selective role of environment in organic evolution, the discipline itself is comparatively young. Its problems are immensely complex, many of them beyond neat experimental control. It must draw heavily upon other fields of knowledge, including those that deal with human behavior. It has also suffered from what is best called "a bandwagon effect," due to sudden awareness by the public of critical environmental problems.

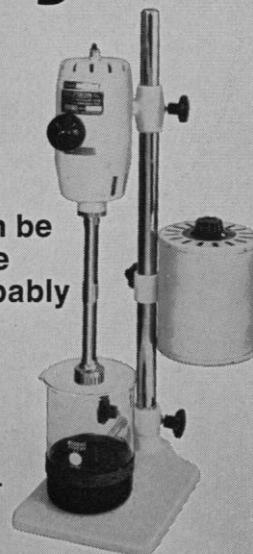
These problems, notably depletion and disruption, have been identified and described in print by ecologists for several decades. But circumstances, not without a measure of vested interest and academic snobbery, have muted their influence on educational programs. This is changing, thanks to public opinion, but also thanks to instances of enlightened administrative leadership, such as that of Samuel Dana at the University of Michigan some 20 years ago.

I have in the past encountered two very different but both honestly meant criticisms of ecology. The first, that it

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is merely a formal attempt to emphasize the obvious; the second, that it is a legitimate enterprise but must be deferred until we know a lot more than we do. I cannot help being reminded of Pepys' account of Charles II scoffing at the men of Gresham College wasting their time trying to weigh air. This chimerical business, we should note, led to the discovery of oxygen, the founding of modern chemistry, and plant and animal physiology a century later.

It may clear matters somewhat to modify the usual definition of ecology as the science of interrelation between life and environment. Actually it is a way of approaching this vast field of experience by drawing upon the *best information available* from whatever source it may come, with precise experimental control where possible, of course, as in the superb watershed studies of Herbert Bormann and his associates. But one cannot, for example, interpret the ecology of a deciduous forest, an urban complex, or the East African plains, while ignoring their history, despite the imperfections of the record. Geology, too, has had to face this problem and survive skepticism, which is confined today to the Fundamentalists.

The fact that a great deal of ecologically indispensable work is being done by those who do not call themselves ecologists does not validate an indictment of the profession as incompetent to deal with anything more significant than goldfish bowls.

It is the special responsibility of the ecologist to discover, assemble, and interpret whatever is pertinent and sound. Often, as by Frederic Clements, Sir Arthur Tansley, Patrick Geddes, and Charles C. Adams, this charge has been powerfully and effectively met.

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Linear Algebra Problem

With respect to Bosch's article "Redwoods: A population model" (23 Apr., p. 345), I wish to inform Bosch, the editors of *Science*, and its referees that they have all just failed elementary linear algebra (see Technical Comments, p. 435).

MITCHELL TAIBLESON

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22 OCTOBER 1971



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