HOW FAR CAN MAN GO IN "CONTROLLING" NATURE?

By ignoring ecological limits he may imperil his own existence

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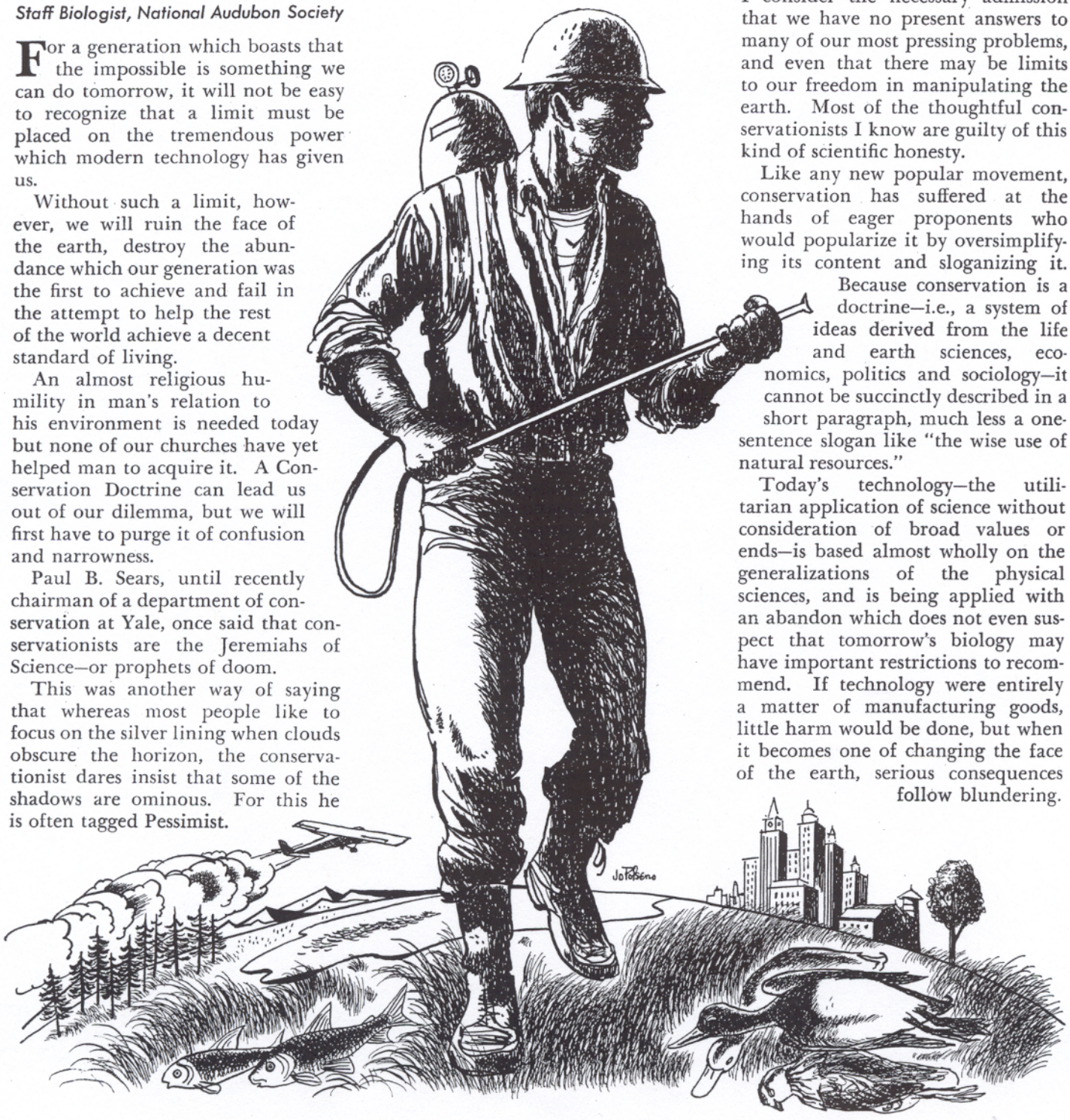
For a generation which boasts that the impossible is something we can do tomorrow, it will not be easy to recognize that a limit must be placed on the tremendous power which modern technology has given us.

Without such a limit, however, we will ruin the face of the earth, destroy the abundance which our generation was the first to achieve and fail in the attempt to help the rest of the world achieve a decent standard of living.

An almost religious humility in man's relation to his environment is needed today but none of our churches have yet helped man to acquire it. A Conservation Doctrine can lead us out of our dilemma, but we will first have to purge it of confusion and narrowness.

Paul B. Sears, until recently chairman of a department of conservation at Yale, once said that conservationists are the Jeremiahs of Science—or prophets of doom.

This was another way of saying that whereas most people like to focus on the silver lining when clouds obscure the horizon, the conservationist dares insist that some of the shadows are ominous. For this he is often tagged Pessimist.



But true pessimism involves what I consider the necessary admission that we have no present answers to many of our most pressing problems, and even that there may be limits to our freedom in manipulating the earth. Most of the thoughtful conservationists I know are guilty of this kind of scientific honesty.

Like any new popular movement, conservation has suffered at the hands of eager proponents who would popularize it by oversimplifying its content and sloganizing it. Because conservation is a doctrine—i.e., a system of ideas derived from the life and earth sciences, economics, politics and sociology—it cannot be succinctly described in a short paragraph, much less a one-sentence slogan like "the wise use of natural resources."

Today's technology—the utilitarian application of science without consideration of broad values or ends—is based almost wholly on the generalizations of the physical sciences, and is being applied with an abandon which does not even suspect that tomorrow's biology may have important restrictions to recommend. If technology were entirely a matter of manufacturing goods, little harm would be done, but when it becomes one of changing the face of the earth, serious consequences follow blundering.

Biology, unfortunately, has had to wait until physics and chemistry had provided it with a blueprint of the substrate of life. This necessary lag in the growth of knowledge has been responsible for a great deal of mischief.

To me, the most exciting and promising aspect of biology today is what we rather loosely call ecology. It is population biology, the study of *communities* of living things, rather than of individuals *per se*.

Ecologists are not merely renewing the age-old argument over nature versus nurture when they insist, as David Pimental of Cornell University did recently, that "nature's secrets concerning an individual plant or animal lie not only within that plant or animal but also, and with equal importance, in the environment and community of which it is a part." Or, as philosopher Alfred North Whitehead expressed it, knowledge of things cannot precede a knowledge of their interrelation—a thing is everywhere: where it is and where it acts.

Rene DuBos of the Rockefeller Institute, who is a good medical ecologist, has reminded us of the universality of this principle.

"It is certain," he wrote, "that the disappearance of one kind of microbial population is rapidly followed by the development of another kind which brings in its train unexpected and often dangerous consequences. The difficulties that may follow antibacterial therapy are, in fact, similar in essence to those encountered in any attempt to control predators in nature."

Turn to next page

Limits in Populations

Biologist Garrett Hardin, in NATURE AND MAN'S FATE, has outlined some steps in the growth of this new idea of man's need of humility in the face of nature. Field studies are vitally necessary to provide the scientific findings showing why man's efforts to control nature must be limited at a certain point. The problems cannot be adequately reconstructed in the laboratory. This change of emphasis will require a revolution in the teaching of biology.

The Principle of Competitive Exclusion—which states that no two populations with similar requirements can occupy a common habitat without ecological specialization—is an important idea in biology. It is already an axiom that the more successful a species is, the more it will become its own chief competitor. To appraise such tendencies, we will have to learn to use the word "competitor" without connoting an "enemy."

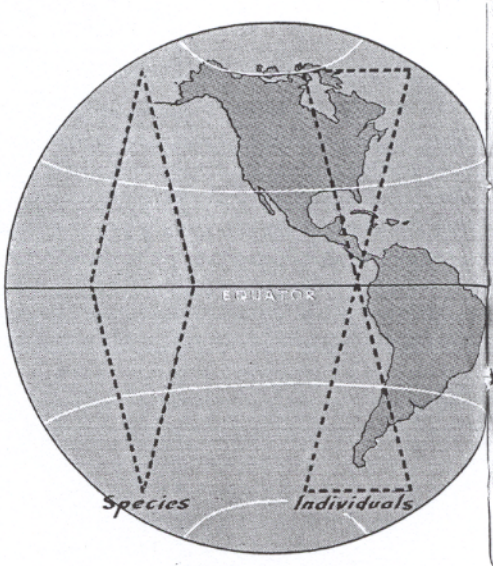
As we "conquer nature" and eliminate harsh competition with the environment—through the control of the so-called crowd diseases, for example—we become prey to social stress. Like the pressures that lead to the breakdown of lemming populations every four years, social stress is the result of too much togetherness. So stress and conformism (the latter also a function of growing population density) are prices we pay for disregarding the principle of competition.

Population biologists have discovered that the individuals in a population of mammals are healthiest when that population exists at 50 per cent of the carrying capacity of the environment. Here is a criterion for determining a human population optimum that deserves testing!

Being resilient, nature can be made to yield more on a short-term basis, but it is a question whether increasing the efficiency of our energy pumps—say corn plants—is the best way of getting the most return over the longest time.

We are very proud of the 20 per cent increase in the yield of corn made possible by Henry A. Wallace's hybrids during the 1930's. This produced the first average increase in corn production in 400 years! But Dr. William A. Albrecht of the University of Missouri tells us that this yield is a purely quantitative one: that the protein quality of the hybrid corn is lower than that of the old corn.

This makes progress a matter of definition. And, unless we insist on a broad definition, progress will most often be defined for us by those who stand to profit from their particular interpretations.



Numbers of species of crustacean *Caluna* increase nearing Equator but numbers of individuals drop off sharply—an example of how nature limits population to achieve stability. **(See page 225.)**

The increasing use of chemical insecticides in agriculture is also a technological defiance of the principle of competition. The farmer *has* increased production thereby, but at the price of assuming all of nature's functions in keeping insects in check, for one thing. His costs mount and his profit margins narrow, and his very existence becomes more and more precarious. This problem led British ecologist Charles Elton to sum up the reasons for conservation in a treatise on the principle of diversity that is sparking a revolution in thought.

Woodlands or Tree Farms?

Modern forestry, which is increasingly technological rather than sylvicultural, raises similar doubts. The idea of "tree farming," which started as a means of encouraging small woodlot owners to practice good forestry (sylviculture), is now being applied to large holdings with the full panoply of modern technology's tools.

An article about the Douglas fir region of the Northwest in a recent popular magazine points this up enthusiastically. With only slight exaggeration, we are told that cutover areas will be treated with chemical herbicides to suppress all competitive vegetation (rodenticides will be used to kill off all bark-nibbling mice and hares), and the new trees, grown from choice nursery stock, will be spaced and managed like orchards. They are expected to yield twice as much timber.

Is this another case of improving the pump while neglecting the question of long-run productivity of the well itself? Foresters have their own long record of ecological blunders. These include the much-touted Black Forest of Germany and the enthusiastically promoted planting of red pine in the northeastern United States. Presumably the technologists among them now feel that they have so many new tools that they can at last bend nature to their will. Again, perhaps too few have thought of asking whether forestry is a business of growing 18-foot logs or the responsible art of managing forest communities.

Efficiency is something we learned in the cotton mill and the foundry but are now trying to apply to mother nature herself. To many modern foresters, for example, all growth in the forest which cannot be converted to dollars is "waste." Industrial foresters have no hesitation in asserting that all remaining virgin timber, because it is no longer growing at a rate comparable to compound interest on a dollar, is "wasteful." For this reason, national parks and wilderness areas are "wasteful," too.

Ecologists have come across a new idea that seems to me to have a bearing on this question of efficiency versus wastefulness. It is called the Principle of Effective Food.

An entomologist studying blowfly populations found that when the flies laid eggs on a sufficiently large piece of meat, all the offspring grew quickly and pupated when they attained a weight of 60 milligrams. When the food supply was smaller, the insects grew more slowly but managed to pupate to adulthood providing they had attained a weight of 25 milligrams. But when too many tried to live off too small a

Continued on page 224

Continued from page 189

piece of meat, they were all so retarded in growth that none pupated.

All the food was eaten but all of it was *wasted* because it did not contribute to maintaining the population of flies. In nature, then, a food supply (or any productive unit) can be said to be effective only when it contributes to maintaining the community, not just some of its individuals.

Even wildlife biologists, who ought to be better ecologists than foresters if only because they deal with animals instead of plants (animals being higher in the pyramid of life), have succumbed to the lure of technological efficiency. They would butcher a forest to produce more "edge," which produces more rabbits. A good many of them would kill off all the fish, crustacea and many of the insects in our ponds and streams and then restock with a single game species, trout perhaps. College courses in ecology are evidently not yet very effective at inculcating the ecological viewpoint.

Most of these matters are obviously problems in emphasis. Very often they are a result of allowing short-run economics to rule instead of biological principles. We approve of science, but usually end up using only those teachings that gratify our selfish ends. This is one sense in which science is like religion.