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#### References and Notes

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#### Conservation of What?

I heartily agree with P. T. Flawn ("Geology and the new conservation movement," 28 Jan., p. 409) that the absence of geologists from today's conservation groups is unfortunate. It is also unfortunate that the training of geologists, foresters, wildlife biologists, and others who can contribute to conservation is usually deficient in the humanities and the social sciences. . . . The conservation movement is severely handicapped by a shortage of men of broad vision. . . .

Flawn criticizes "preservationists" as being unrealistically "opposed to change." But preservation of non-economic values has its place along with sensible exploitation of natural resources. It is shortsighted to say, as Flawn does, "The preservation of an old building simply as an architectural and historical monument in the midst of a growing city where there is great demand for space can hardly be justified unless the building can be converted to serve a useful purpose as well as being a monument. This is multiple use." In this sweeping statement, the University of Texas professor says, in effect, that the Alamo in San Antonio is useless, that it should either be destroyed or converted into—for example—a shopping center. Can a dollar value be placed on the Alamo? It is a priceless shrine to patriots who died for the sake of Texas liberty. Texans unborn deserve the opportunity to visit the Alamo. As a citizen of Illinois, I would gladly pay taxes to preserve the Alamo. Illinois has some old buildings, too. How much is the Lincoln home in Springfield worth? The house is near the state capitol, and the site would be desirable for an office or an apartment building. Would its destruction be progress? Would the destruction of the Acropolis in Athens and the construction of a hotel on its site be

progress? How about Mount Vernon as the site of a sewage treatment plant, and Independence Hall as an office building? Wouldn't historians and architects be better qualified than geologists or economists to judge the importance of such buildings and sites?

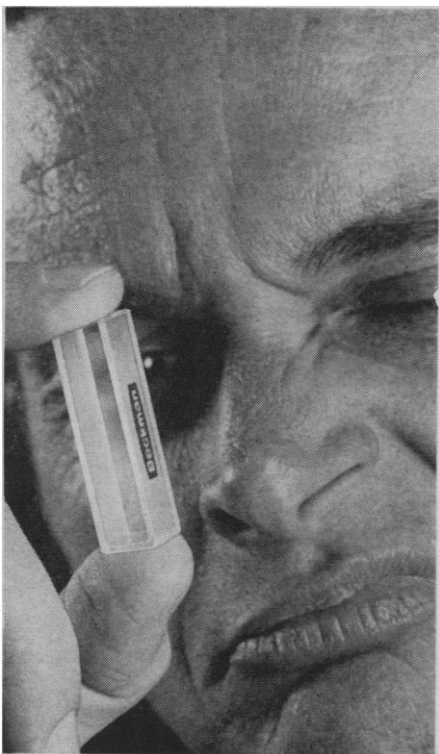
Flawn continues, "Likewise, preservation of a potential rock-quarry site as a woodland glade constitutes elimination of a valuable mineral resource and costs society a substantial amount of lost tax revenues and lost payroll." But doesn't the value of the glade depend also on its botanical and ecological significance? Who is better qualified to judge the importance of a particular woodland glade, petroleum geologists or a team of plant ecologists, plant taxonomists, landscape architects, and park planners? Gravel pits are needed, but so are woodland glades, especially near centers of population. Certainly the redwoods of California could be eliminated to someone's profit. Grand Canyon can be converted to Grand Lake and enhance the real estate market in Central Arizona. . . .

The starving and impoverished, to be sure, can have little interest in esthetics. In conservation, as in other large problems, there are no short cuts to wisdom. We need master planning for resource use on the international as well as a local scale. But man's future does not rest upon economic expediency alone. We need to define and practice what the late Aldo Leopold referred to as the land ethic. Both tangible and intangible values must be considered. Why shouldn't we be willing to pay a price for the preservation of beauty, of flora, fauna, and geological wonders, and of reminders of history, all of which enrich the quality of man's existence?

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. . . Flawn picks a questionable example to illustrate what he refers to as "the multiple-use concept." Discussing the choice between preservation of a woodland glade and operation of a rock quarry, he writes: "In line with the multiple-use concept, the rock could be quarried over the economic life of the deposit and thereafter the area could be landscaped and restored for other uses." What he proposes is not multiple use; it is one kind of use followed by another kind of use, and



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in the process the original woodland glade would be destroyed.

The criticism may seem carping and picayunish, but it has a most serious purpose. In this hypothetical case, as in most actual cases, a selection must be made from among conflicting uses. By no stretching of the imagination can the choice of one at the expense of others be made to constitute "multiple" use. The so-called "preservationist" point of view rests pretty strongly on this basic fact. Supporters of the multiple-use idea promise something for everyone; "preservationists" are only too well aware that this is an impossible goal.

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. . . While on some points Flawn questions the continued serviceability of our private-property system, he seems to me too orthodox in uncritically accepting much of the economic mythology of valuation and growth. For example, the objection to "locking up" space in the face of economic demand by preserving an old building (it is easy to stretch this outlook to local parks, bird sanctuaries, and the like), and the complaint about "lost tax revenues and lost payroll," should be extended to the speculative holding of land, which keeps much more acreage out of use. And in an age when a single 4- by 6-foot Rembrandt seems worth \$2,300,000 to the trustees of an art museum (all of them hard-headed businessmen), who is to say how much we can or cannot afford for open space?

Flawn says, "Although conservation is frequently defined as effecting a harmony or balance between man and his environment, such a goal can never be achieved in an industrial environment. . . ." I challenge this notion. Our consumption of raw materials, as Flawn recognizes, need not disfigure the landscape. Government can, without assuming "complete authority" in planning, foster better use of the land than our "accidental century" (see Michael Harrington's 1965 book of the same name) has so far produced. The government's role is to set limits. The mining of Texas of oyster-shell reefs which Flawn describes is an excellent example of why more far-sighted policy by industry, the states, and the federal government is needed. The uses to which the shell is now being put—

chemicals, aggregate, and road base—are all lower uses; the highest use, now being disregarded, is biological productivity. These shallow Gulf Coast bays are indispensable as producers of shrimp, finfish, and shellfish; great colonies of colorful birds depend on them; and these resources, whether labeled business, sport, tourism, or pleasure, are worth more to society in the long run than whatever return the liquidation of the shell banks is bringing to a few politicians and a small segment of the industry. If the dredges are allowed to finish excavating, these bays will become sterile sinks, because deep water is relatively unproductive. The tragedy of shortsightedness is that we could have both kinds of products from the bays; not, however, if the cost of mammoth dredges has to be amortized within a few months!

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. . . A major obstacle to conservation is the lack of understanding by the general public and by political leaders of the nature of economic growth. It is generally assumed that economic growth is always good and that a decreasing rate of growth is bad. . . . Progress is measured largely by the rate at which physical goods increase. This assumption may have been valid in the past for the major industrial nations, and may still be valid for the underdeveloped nations. But it needs more careful scrutiny in the light of what we know about the nature of the growth process. . . . If we blindly insist upon maintaining a constant rate of economic growth and use of natural resources on the present basis, we practically guarantee an "explosive" situation. Not only does a constant rate of growth of production entail consumption of raw materials and energy at an explosive rate, but along with that go production of pollutants and other adverse alterations of the environment at explosive rates. The situation is even worse if population also grows explosively—that is, at a constant rate.

Thus, in a broad sense conservation implies reexamination of some long-cherished goals and values of our society. Some activities, such as producing and riding in two-ton cars, are enormously wasteful of probably irreplaceable raw materials and energy. Other activities, such as reading books, watching plays, dancing, art, music, en-

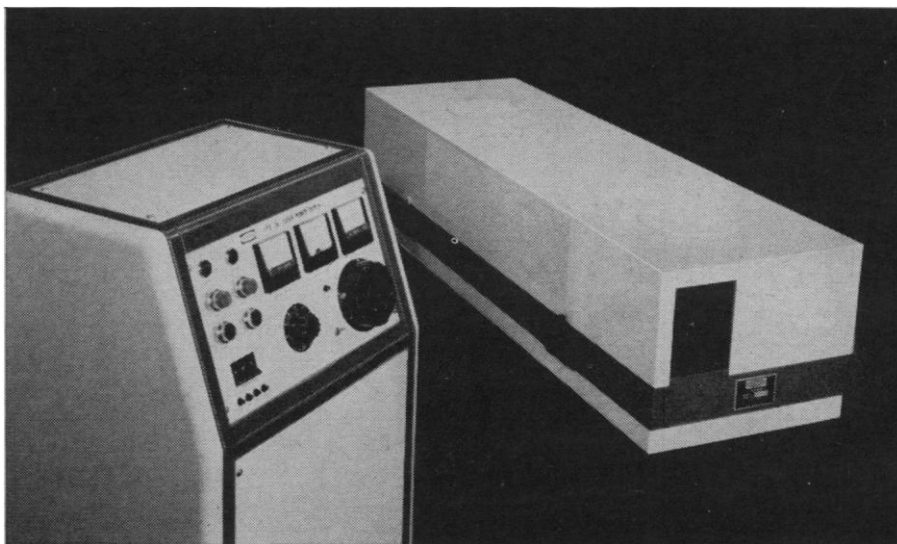
tail very small use of matter and energy. Perhaps we should begin to designate a conservation index for various activities—high indices for activities that imply little use of resources, and low indices for those that are wasteful of matter and energy. Increased efficiency of production and use will help, obviously, but we must also begin to encourage participation by consumers in those activities that have a high conservation index. Certain economic activities—production of food, water, and shelter—should, obviously, have high priorities. War and production for war are, of course, the most wasteful of all activities, since they consume raw materials and energy without any basic contribution to human welfare. . . . Some may believe, as a matter of faith, that scientists can solve any problems that arise, so long as they are given enough money. Many scientists are becoming increasingly uncertain that they can fill the bill. The world is finite and its resources are finite.

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. . . I commend Flawn for presenting many important conservation ideas in his addresses before organizations made up of individuals who may have relatively little understanding of the concepts. But he errs in saying that the rape of the Appalachian coal fields, which conservationists criticize today, all took place 50 years ago. Conservationists are rightly protesting the very recent forms of exploitation based on the use of large, modern earth-moving equipment.

I would like to point out a few ways that geologists might actually aid in conservation of man's environment. Our profession can and should point out the lack of judgment often exhibited by state and federal agencies in locating and building dams on sites chosen for political motives. We should advise on proper watershed management as a means of permanent flood control that would eliminate dependence on temporary check-dams and reservoirs. Local, state, and federal planning agencies are badly in need of scientific advice on land use, and geologists can make a major contribution to this. They can counsel against extensive construction on unstable substrates or areas subject to rare but devastating flooding. Existing forest practices, carried out without regard for



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the long-term effects of soil-cover destruction and concomitant flooding, are seriously in need of revision in the state of California and other areas; geological opinions and facts are needed to help formulate effective legislation. In short, the geologist should have the ability to see the temporal position of mankind and his fellow organisms in the total environment of the surface of this planet, and he, above all, should advise his fellow men of their role in this evolving, dynamic interplay.

I am pleased to learn that the theme of the AAAS meeting in Washington this year will be conservation. Before that meeting, let us at least try to agree on a definition of that term.

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Flawn has done a service both to geologists and to conservation in pointing out that "geologists are conspicuous by their absence from today's natural-resource planning groups, local, state, and federal . . . [perhaps because] geologists are regarded in government circles as champions of the mineral industry, rather than as conservationists." The same could be said of mining and petroleum engineers, probably because, as Flawn notes, "There is a disturbing aspect of the new conservation movement in that the extractive industries and the mineral industries in particular are regarded as rapacious despoilers and looters of the nation's resources." The use of this vituperative vocabulary to disparage the development of resources by American private enterprise for the use of the American people, and thereby to promote government control, has been going on for a long time. The intention to use the conservation movement to bring about what most dictionaries call socialism was clearly stated in Gifford Pinchot's article "Breaking new ground," published some 40 years after the famous 1908 White House Conference on Conservation (and reprinted as "What it all means" in *Readings in Resource Management and Conservation*, I. Burton and R. W. Kates, Eds., Univ. of Chicago Press, 1965). Pinchot said: "Conservation is the application of common sense to the common problems for the common good. Since its objective is the ownership, control, development, processing, distribution, and use [emphasis mine] of natural resources for the benefit of the

people, it is by its very nature the antithesis of monopoly." Many sound and sincere conservationists, including geologists and engineers, want no part of the scheme to use the conservation movement to socialize natural resources.

Geologists and engineers have done a spectacularly effective job, without publicity in conservation literature. It is no coincidence that there have been adequate oil and other mineral supplies for the 20th-century wars and for the maintenance of the economy in the meanwhile. It has been due to the operation of the scientific, engineering, executive, and technological talents and skills of the most capable discovery and development personnel in the world—almost all in private industry. Transfer of access to undiscovered mineral resources from this capable body to "resource managers" or government agencies by wholesale segregation of land under the mining and leasing laws could be a national catastrophe.

The Multiple Use Act (Public Law 88-607, 19 Sept. 1964) might be interpreted to do just that. Parts of section 1 provide for the Secretary of the Interior to determine which lands "shall be retained . . . in Federal ownership and managed for . . . mineral production." Section 4 provides that classification for retention "shall have the effect of segregating such land from . . . disposal under . . . the mining and mineral leasing laws. . . ." The Multiple Use Act is temporary, enacted "pending the implementation of recommendations to be made by the Public Land Law Review Commission." Flawn's alert regarding the absence of mineral exploration and development experts from high conservation councils is most timely. The portents of government management are indeed ominous. Geologists, engineers, and everybody else, including the Public Land Law Review Commission, need to be aware of this potential for nullifying the most successful land policy in all history.

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### Linear Algebra: Teacher's Problem

I am a physicist with the usual sort of background in mathematics and am teaching mathematics to high school students. It has been my observation