upon a dual campaign aimed at continuing the wartime organization and also at convincing the public of the "explicit relevance of the values of professional science to the values of nonscientists" (p. xi). These are the two meanings the author gives to his label "national science," and he indicates that he will be more concerned with the second.

The author carries the story through Science Service, an organization founded by E. W. Scripps for the purpose of convincing the public that pure science was the basis of social progress, through the controversy, to which he attaches enormous importance, over Einstein's theories, to the abortive campaign for a National Research Endowment, which he sees as the final death of the movement.

One can quibble with the author at certain points. This reader, for example, believes that he attaches far too much importance to the Einstein controversy as a cause of the alienation of the public. To say that it "shared national attention with the strike of coal workers, . . . disagreement between President Wilson and the Senate critics over ratification of the Versailles Treaty, the Russian civil war, and the political struggle over prohibition" (p. 105) is to suggest too great a degree of public interest in science and to mistake a few editorials in the *New York Times* for a national furor. One could even question the existence of a well-organized "movement" and could wonder whether the idea of a "national science" was ever as clear to those involved as it is to the author.

But saying the obvious—the book is not perfect—should not detract from the recognition that Tobey has an important story to tell and that, in general, he tells it well. That the effort, well organized or not, confused in the minds of proponents or not, to develop a "national science" during that period failed did have the consequences that Tobey suggests, and those consequences are still with us. Neither the values nor the method of pure science have been integrated into the liberal consensus, engineering and technology do still continue to possess the name of science and to be more highly regarded than pure science, and the failure did make inevitable the conclusion that war, hot or cold, is the only justification for national science (p. 230).

The reasons for the failure are clear. The conservative ideology of leading scientists made it difficult to secure the necessary primary relationship with the general public and to maintain the independence of pure science from industrial capitalism (p. 200). On the other hand, the effort to convince business to subscribe to a fund for pure science out of self-interest failed because industrialists could not be convinced that pure science, rather than engineering or applied science, was the basis of industrial profits (p. 217). Pure scientists, faced with a similar difficulty today, may find it instructive to study their predecessors' efforts.

GEORGE H. DANIELS
Center for the Interdisciplinary Study of Science and Technology, Northwestern University, Evanston, Illinois

Ecological Perspective

Ecosystem Structure and Function. Proceedings of the 31st Annual Biology Colloquium, Corvallis, Ore., April 1970. JOHN A. WIENS, Ed. Oregon State University Press, Corvallis, 1972. 176 pp., illus. $5.

The global ecosystem is permeated everywhere by man the exploiter, whose behavior as such is so inextricably linked to a complex web of social, economic, and political mores that simple solutions will work only rarely. Ecological understanding has been sorely missing in the past, but the ultimate resolution of mankind's awesome problems will require the collective wisdom of all elements of society, incorporating a sound ecological perspective.

This neat book contains the proceedings of a colloquium on the timely topic of ecosystem structure and function. Eugene Odum as colloquium chairman gave the opening address and led the discussion. The concept of the unity of organisms and environment is an old one, but the use of the word ecosystem to express it was first proposed by A. G. Tansley in 1935. Ecologists have derived the following significant ideas from their analyses of ecosystems: Energy declines and materials, including pollutants, concentrate with each step in the food chain. High biological productivity is achieved through energy subsidies. Both harvest and pollution stresses reduce the energy available for self maintenance, and man will have to pay the cost of added maintenance including instabilities, vulnerability of plants to insects, and social disorder. Diversity is directly correlated with stability of ecosystems and perhaps inversely correlated with productivity. Human population will overshoot some vital resource unless man can reduce growth rates. Recycling of water and minerals must become a major goal of society. Odum concludes, "In an industrialized society energy is not likely to be limiting, but the pollution consequences of the use of energy and exploitation of resources are limiting."

Nutrient cycling is closely geared to all ecosystem functions and chemical weathering is regulated by decomposition. G. E. Likens and F. H. Bormann elegantly describe how man will protect his own interests if he harvests ecosystems more intelligently. For example, if the bark is stripped from logs before they are removed from the forest much calcium will be returned to the forest floor. Frank Golley in his lecture on energy flux through ecosystems gives a splendid summary of net and gross primary production in the global ecosystems. He goes on to comment in answer to a question that man will err in his interaction with parts of the biosphere and that we must preserve the repair processes to bring the system back to equilibrium. Golley suggests that these repair processes exist within the natural habitats of the world. The book is enlivened by inclusion of the questions and answers following each paper. Gordon Riley following his fine description of patterns of production in marine ecosystems was asked about the productivity of the open oceans, the harvesting of which he described as an engineering and economic challenge to man.

By far the most technical paper of the colloquium is one by E. C. Pielou on the measurement of structure in animal communities, in which she describes "the innate unpredictability of ecosystems" but notes that we should avoid errors which are avoidable by the use of factual knowledge and sound reasoning. A splendid description of the evolution of natural communities is given by R. H. Whittaker and G. M. Woodwell. The colloquium discussion ends with several astute comments by Whittaker to the effect that we need to relate population and biosphere, resources and economic function, cultural morale and political means, and that there "might emerge an integrated strategy for the human future."

DAVID M. GATES
Department of Botany and Biological Station, University of Michigan, Ann Arbor