Aldo Leopold

Thinking like a Mountain. Aldo Leopold and the Evolution of an Ecological Attitude toward Deer, Wolves, and Forests. SUSAN L. FLADER. University of Missouri Press, Columbia, 1974. xxvi, 284 pp., illus. $12.50.

This definitive, detailed, and exhaustive account of the development of Aldo Leopold's thinking about deer, predators, and the forest in which they all must live and with which man would like to live in so many different ways will be of great interest and value to the practical ecologist, forester, and game manager. Now and then we lose sight of the deer—and of Aldo Leopold—in the forest of details. Yet, as everyone who has been in that interface between science and public emotion knows, these matters cannot be explained in simple, brief statements, or reconciled to everyone's satisfaction in monosyllables. The professionals, therefore, will welcome this book, and for courses in biopolitics it will be a good text. Those of the much greater audience who have taken *Sand County Almanac* to their hearts as an ecological classic will find more details in it than they need, but it is excellent browsing, especially the first chapters. The lesson, implicit on every page, should not escape even the most casual scanner: a good man can learn from experience and can recognize when his ways or ideas are in error, and can change or adjust them as he grows in knowledge and wisdom.

JOEL W. HEDGPETH
Pacific Marine Station,
Dillon Beach, California

Celebration

Three Centuries of Scientific Hydrology. Papers from a conference, Paris, Sept. 1974. UNESCO, Paris, World Meteorological Organization, Geneva, and International Association of Hydrological Sciences, Paris, 1974 (U.S. distributor, Unipub, New York). 124 pp., illus. Paper, $8.25. A Contribution to the International Hydrological Decade.

In 1974 the International Hydrological Decade came to a close and an International Hydrological Programme was begun. That year was also the tercentenary of the publication of Pierre Perrault's *De l'origine des fontaines.* The eight papers in this volume (all but two in English and each accompanied by abstracts in English, French, Spanish, and Russian) stem from a conference marking these events. Some of the papers review the development of hydrology as a recognizable scientific discipline distinct from meteorology, hydraulics, physics, chemistry, and engineering, which are its main building blocks. Others try to look ahead.

The introduction to the book contains the following statement:

> The outstanding merit of Pierre Perrault was that, in ... *De l'origine des fontaines*, ... he demonstrated by means of quantitative evaluations that rainfall and snowfall are responsible for riverflow. ... This break-through justifies the decision to accept Perrault's work as the point of departure of scientific hydrology and to celebrate its Tercentenary in 1974.

Contributions by Mariotte and Hally, among others, followed soon after that of Perrault and mark "the beginning of quantitative assessments of the water cycle which were essential for the further development of hydrology."

The historical reviews give fascinating glimpses of the hydrology of the distant past—use of rain gages in China about 1000 B.C. and development of the concept of the hydrologic cycle in China about 900 B.C. and again in Greece in 500 B.C., and then oblivion for about 2000 years, in Europe with the authoritarianism of Aristotle and the advent of the Dark Ages, and in the Far East with the disappearance of scientific thought for other causes at about the same time. The gaging of the Nile flood in relation to assessment of taxes comes in for mention, as does the history of the current meter and its use not only to measure flow in streams but also, in early days, as a navigational aid toward determining longitude.

Through the historical accounts runs the theme of the development of quantitative methods prerequisite to a scientific discipline. The goal was not achieved, really, until the late 19th and early 20th centuries.

The pattern of modern hydrology has been shaped largely by conceptual models capable of manipulation, for some decades now with the help of computers, analog and especially digital. The growth of concern for the environment in recent years has led to extreme emphasis on water chemistry in relation to use as well as imposed esthetic constraints on water-management structures.

The future is seen in this book as holding further development of quantitative methods, increasing use of real-time data through the agency of the Geostationary Orbit Environmental Satellite (GOES) and other satellite data relays, development of other remote-sensing devices and methods for application to hydrology, and continuing emphasis on water quality in relation to public health and to recreation.

The last two papers in the volume both include the tantalizing statement that only 2 to 8 percent of the yearly global flux of fresh water is actually withdrawn for use by man. That idea accords poorly with the current concern worldwide about a water crisis, except in the context of concentrations of population, agriculture, and industry. The extent of such major use areas relative to the world total is not given. Unfortunately, neither paper develops the idea to a really useful degree.

Altogether, hydrologists and all others interested in water will find fascinating tidbits in this volume. None of the papers is profound or difficult to read. The papers are what they were intended to be—a celebration of growth in hydrologic thinking.

J. H. FETH
U.S. Geological Survey,
Menlo Park, California

Ecology from Russia

Schooling in the Ecology of Fish. D. V. RADAKOV. Translated from the Russian edition (Moscow, 1972) by H. Mills. Halsted (Wiley), New York, 1973. viii, 174 pp. illus. $19.75.

Soviet science as a whole is more mission-oriented and practical in intent than American science. The organization of fish schooling is an example of a relatively narrow topic that has received unusual attention within the U.S.S.R. because of its potential economic importance, in this case the development of techniques to increase the sustained yield of catches. For the student of animal behavior and ecology, therefore, Radakov's book provides an opportunity to examine the state of the art in a sector that has been relatively well supported financially. While not neglecting some of the key American and Western European literature, Radakov has concentrated heavily on Soviet contributions in an attempt to summarize them thoroughly. I believe the result can be fairly described as follows: strong on factual, descriptive accounts of free-living and laboratory schools, weak on physiology and basic behavior, and virtually lacking in basic ecology and population biology.

Radakov makes some good generalizations. His definition of a fish school is as sound as any hitherto devised: "a temporary group of individuals, usually of the same species, all of which are in the same

phase of the life cycle, actively maintain mutual contact, and manifest, or may manifest at any moment, organized actions which are as a rule biologically useful for all members of the group." He confirms that schools serve multiple functions, and that the same school often varies in organization from moment to moment according to the function being served. The responses of schools to live predators and to trawls are compared in an interesting way, and numerous accounts of schooling in less familiar species are presented. This is a useful book, but the reader will look in vain for any important new discoveries or conceptual advances.

EDWARD O. WILSON
Museum of Comparative Zoology Laboratories, Harvard University, Cambridge, Massachusetts

New Direction in Epidemiology

Life Stress and Illness. Papers from a symposium, Beito, Norway, June 1972. E. K. ERIC GUNDERSON and RICHARD H. RAHE, Eds. Thomas, Springfield, Ill., 1974. x, 264 pp., illus. $19.50.

Stressful Life Events. Their Nature and Effects. Papers from a conference, New York, June 1973. BARBARA SNELL DOHRENWEND and BRUCE P. DOHRENWEND, Eds. Wiley-Interscience, New York, 1974. xii, 340 pp., illus. $19.95.

Scientific paradigms are sometimes not so much discarded or revised as revitalized by methodological innovations. The theory that stressful life events cause physical and psychological illness in predisposed individuals is as old as medicine, and was a cardinal principle in the beginnings of psychiatry. But the study of this theory centered largely on clinical investigations of individual patients who selected themselves by complaining of illness. Psychological and sociological field studies were also concerned with the concept of stress, but the meanings attached to the term were diffuse, operational definitions varied, and differing methods of uncertain reliability prevailed. A resurgence of interest in the relationship of life events to the onset of illness is now upon us. It is due in large part to the devising of simple scaling procedures for deriving single scores for presumptive life stress. Those procedures and their preliminary results are the central topics of these two books. The findings are strikingly interesting but not decisive.

Both books derive from conferences on stress. *Life Stress and Illness*, edited by Gunderson and Rahe, consists of papers presented at a NATO-sponsored symposium at Beito, Norway, in 1972. *Stressful Life Events*, edited by the Dohrenwends, is also based on a symposium, this one held in New York in 1973. Although there is some overlap in contributions, owing to the importance of the work of Rahe, Paykel, Theorell, and Brown, found in both volumes, the two books together form a package vital to investigators. They carry the latest word on methods and methodological problems in the quantification of stressful life events.

One reason for the recent wave of interest in life event scaling is the face validity of the new methods. In these volumes chapters by Holmes, Masuda, and Rahe summarize how the authors developed lists of specific life events that may evoke either pleasure or pain but share the feature of causing change in the life habits of an individual. The total presumptive impact of events, in a given time period such as six months, is obtained by weighting each event numerically and adding the weights for every event experienced during that time period.

The weights are derived from subjective judgments of the degree of upset or adjustment triggered by an event, and these judgments can be assembled as group means. Persons are given a scale of 1 to 100, and asked to rate, for example, the death of a child somewhere along this range. In order to locate sectors of the scale "100" is designated as the maximum conceivable "upset" for a person and "1" as no impact at all, with, in some studies, "50" given as an appropriate score for the degree of impact of a marriage. Naturally persons vary in their numerical judgments, but the group average will assign the death of a child a score or weight in the 90's. Later, after the values for various events are established in this way, other groups of persons can be given the list of events and asked simply to check those that have recently happened to them.

Here is where face validity comes in: persons will not vary widely in the accuracy of such yes-or-no responses. Major memories about car accidents, separations, divorces, deaths, or bankruptcies are less subject to response biases than answers to questions about moods, emotions, ideation, or adequacy of psychosocial function. Similarly, episodes of illness are also fairly definite and can be counted. A denial tendency will remain as a confounding variable, but there is less variance than with inquiry into subjective states.

Once a person has checked off events that pertain to him, a rapid procedure, a life event cumulative score can be obtained by finding and adding the weights assigned to those events. The sum is a number indicative of the presumptive degree of "life change" or "life stress," however these terms are defined in the procedures of a particular study. An extension in which weights are applied according to the recency of an experience is offered by Horowitz, Schaefer, and Cooney in the Gunderson and Rahe volume. The cumulative effect of these methods of scaling is to allow investigators to composite life event data into numerical forms suitable for use in large-scale field studies on the interaction of life events and their possible physical and psychological consequences.

The conferences were held to examine these methods and to consider their potential in the light of promising early findings. These findings, from multiple laboratories, consist of significant, positive, and sometimes large-scale correlations between life change or stress and a variety of physical and psychiatric illnesses. The main problem of interpretation of the findings lies with the fact that most of the studies obtain retrospective data. Commendably, this issue is ably discussed in both volumes.

Among the findings of compelling interest are those of Holmes, Masuda, and Rahe. In various chapters in the two volumes, these investigators report a general correlation between all types of life events and all types of physical illness, with a focus on life changes that vary from positive to negative in effects.

Theorell, in the Dohrenwend book, and Rahe and Romo in the Gunderson and Rahe book, find significant positive correlations between heart attacks, occurring relatively early in mid-life, and total "upset" from life events occurring in the preceding year. Those who died as a result of myocardial infarctions had higher levels of recent life change than those who survived such attacks. With respect to psychological consequences, Paykel, in Gunderson and Rahe, reports a significant positive correlation between life events and various types of psychiatric illness. Patients who had made suicide attempts reported the highest magnitude of antecedent life events, followed by persons diagnosed as depressive, and then by persons who had experienced schizophrenic episodes. In the Dohren-