interpreted his results as being in conflict with the theory (that is with Bahcall's calculations) Bahcall maintained (for more than a year) that there was no contradiction betwen the theory and the data. Pinch uses this episode to argue that the notion of contradiction is flexible and negotiable and consequently that philosophies of science that consider theories to be confirmed or refuted by experiments are in trouble. However, one must be careful with the notion of contradiction. In logic, it applies to a given proposition, whereas in the case discussed here the scientists use the term in the general sense of "disagreement" with a theory, which is always a complex system of propositions. For this reason Bahcall can easily maintain that there is no contradiction by pointing to the fact that some of the input data have wide error margins and predicting that the disagreement between theory and experiment will vanish when better input data are obtained. Thus the discussion going on between Davis and Bahcall does not show any flexibility in the logical notion of contradiction but rather a flexibility in the possible predictions of the theory made possible by the flexibility of the input data. Besides, Pinch explicitly notes in the conclusion that interpretative flexibility varies from area to area. This variation seems closely linked with the possibility of playing with the error margins of the input data in a credible way. After all, the fact that Bahcall finally admitted that there was a real problem with the predictions of the model is clearly related, as Pinch himself admits, to the fact that after the publication of new experimental results on nuclear cross sections and solar opacities it became more difficult to play with the main input data. So, the fact that an experiment can be seen at a given time and by different scientists as both compatible and incompatible with a theory has nothing to do with the logical notions of contradiction and consistency, which apply only to a single proposition enunciated by a given individual.

In his research, Pinch relied heavily on interviews, most of them conducted in 1978. Accordingly, it would have been useful to present a more critical discussion of the status of these "data." It seems clear that the scientists' reminiscences cannot be taken at face value, for they are heavily influenced by the scientists' position as "being-interviewed-by-a-sociologist," to use the language of phenomenology. For instance, when Bahcall explains his close relationship with Davis by saying "I had staked my career on my ability to predict the response of the instrument" (p. 116) or that "scientific advancement depended in a large measure on my correctness" (p. 118) he is talking like a sociologist, but quoting these extracts is not a proof that the explanation in terms of interests is true. The effect of the interview is even more evident in the case of Goldhaber. In a paper published in 1967, he had written that he had "often suspected that the theory overshot a little." Intrigued by this remark, Pinch asked him, in 1978, to "elaborate" on it. He answered: "I thought they had a bit oversold it" (p. 124). The change in language is clear, and though it makes more evident the "strategic" aspect of the actions, it is an artifact of the interview situation. In any case, the sociologist does not need to see his analysis "repeated" by the the actors for it to be convincing. The plausibility of his arguments rather comes from the coherence they give to the series of events described, and this even though some actors may disagree with the proposed interpretation.

Fortunately, Pinch's arguments are most of the time convincing, and he has produced an important book that will be useful to historians of science, who will find a sensitive and detailed history of an important episode of modern physics, as well as to sociologists and philosophers of science who want to find a common ground to discuss the hypothetical specificity of science vis-à-vis other cultural activities.

YVES GINGRAS
Département de Sociologie,
Université du Québec à Montréal,
Montréal, Québec, Canada H3C 3P8

Ecological Comparisons

Are Australian Ecosystems Different? J. R. DODSON and M. WESTOBY, Eds. Ecological Society of Australia, [no place], 1985 (distributor, Blackwell Scientific, Carlton, Australia). iv, 250 pp., illus. Paper, $A25. Proceedings of the Ecological Society of Australia, vol. 14. From a symposium, Sydney, Aug. 1984.

Are Australian ecosystems different? Of course they are. They are full of *Eucalyptus*, kangaroos, and flower-pollinating parrots. It is much less clear that they differ significantly in ecological characteristics from ecosystems elsewhere. To produce a preliminary assessment, the Ecological Society of Australia convened a symposium in 1984. The motivation for the symposium was, first, to determine the relevance of overseas research for practical management decisions in Australia, and, second, to explore the extent to which the properties of ecosystems are determined by their present-day environments as opposed to the idiosyncrasies of history. Determining the predictability of the evolution of ecosystems is no easy task. Characteristics of the physical environments of the ecosystems to be compared need to be matched. The length of time current environments have existed is also important; even the most ardent ecological determinist does not expect extremely rapid ecological convergence in regions whose climates have only recently become similar. Once ecosystems have been well matched, appropriate features to be compared must be decided on. Previous assertions about the uniqueness of Australian ecosystems have been based primarily on taxonomic comparisons, which take into account only one of many features of interest.

Among the interesting features for ecological comparison are life history traits, patterns of species richness, species diversity, guild structure, productivity, and successional patterns. Identification of the best units to compare is difficult, and data for some of these units are sparse, partly because community ecology has increasingly focused on species belonging to particular taxonomic groups or guilds within them. Even within one taxon ecosystems may be similar in one trait of interest, say species richness, but not in others, say guild structure. Intertaxon differences are even more pronounced.

The papers published in this volume span the range of comparisons from single families of organisms to communities of species belonging to many different taxa. The environmental traits compared are similarly diverse: marine, freshwater, and terrestrial ecosystems are all treated. The topics were evidently selected on the basis of availability of investigators with something to say about comparisons between Australian ecosystems and those elsewhere.

Not surprisingly, the comparisons differ markedly in the extent of information available, the wisdom displayed in choice of traits to compare, and the goodness of match of sites. Some papers do not really compare Australian ecosystems with those elsewhere. Others compare Australian ecosystems with ecosystems that bear similar names but occur in dramatically different climates. In some cases the communities being compared are taxonomically very similar, making it difficult to separate effects of convergence, if any, from features due to common ancestry.

Among the papers in which the sites are well matched and the community components compared are ecologically interesting and taxonomically distinct are those on macrobenthic animal communities of Tasmania and the Holarctic (B. V. Timms), Australian and Northern Hemisphere streams (P. S. Lake *et al.*), plant species diversity on small scales (B. Rice), tropical insect herbivory levels (M. D. Lowman), phytotelmata (R.

L. Kitching and S. L. Pimm), wetland herpetofaunas (M. P. Simbotwe and G. R. Friend), nectar-feeding birds (H. A. Ford), breeding biology of insectivorous birds (J. C. Z. Woinarski), small mammal succession after fire (B. J. Fox *et al.*), and general community structure (A. V. Milewski and R. M. Cowling). These papers provide a good sampling of the state of the art of intercontinental comparison.

The state of the art is, unfortunately, still rather primitive. Nonetheless, the southern continents offer some of the best opportunities for comparisons because of the relative taxonomic uniqueness of their floras and faunas, their long isolation from one another and from the northern continents, and their relative tectonic stability. What is needed soon is a second symposium or, better, a workshop to identify ecosystems and features best suited for further comparison, the nature of the data needed, and the ways in which future studies can be made more comparative than the past ones.

This volume represents a first step in a long road. It is easy to read, and there are relatively few typographical errors. The art work is varied in quality, and my particular copy of the book quickly fell apart, even with gentle handling.

GORDON H. ORIANS
Institute for Environmental Studies and Department of Zoology, University of Washington, Seattle, WA 98195

Fallout from Yucca Flat

Under the Cloud. The Decades of Nuclear Testing. RICHARD L. MILLER. Free Press (Macmillan), New York, 1986. xii, 547 pp., illus., + plates. $24.95.

Justice Downwind. America's Atomic Testing Program in the 1950s. HOWARD BALL. Oxford University Press, New York, 1986. xviii, 280 pp., illus. $21.95.

Fallout from nuclear testing, which began in the Nevada desert in 1951 and continued regularly, except for the moratorium from 1958 to 1962, until the limited test ban treaty was signed in 1963, created a serious hazard for the American people at the height of the Cold War. The authors of these two books give complementary accounts of the deadly nature of the resulting radiation. The difference lies in their points of focus. In *Under the Cloud*, Richard Miller makes it clear that all Americans, not just those living downwind from the Nevada test site, were exposed to heavy amounts of radiation. The vagaries of wind and rainfall meant that people as far away as upstate New York received heavy doses of strontium-90 and iodine-131. Howard Ball, on the other hand, concentrates on those living downwind from the Nevada test site who experienced sufficient radiation to increase greatly their chances of coming down with cancer and leukemia. Both authors condemn the Atomic Energy Commission for using the imperatives of the Cold War to hide from the American people the real danger to public health and safety from the more than 100 atomic tests conducted at Yucca Flat. The casualties included not only the troops foolishly placed within a few miles of ground zero or the nearby livestock callously destroyed, but potentially all Americans who lived for more than a decade under this ominous shadow.

The strength of Miller's book lies in the detailed account of the individual tests and the careful tracking of the fallout patterns across the nation. He shows both the normal course of the clouds, across the Middle West and upstate New York, and variations that took the deadly material over the South and sometimes even back westward across Arizona and California. His account, together with fallout maps in the appendix, clearly supports his assertion that "every person alive [in the United States] during the 1950s and 1960s lived under the atomic cloud" (p. 9).

His book, however, is too detailed and impressionistic. He fails to offer any sustained analysis of why this serious risk to public health continued for so long without any effective public protest. By focusing on the tests themselves, he tends to slight the policy issues they raised, and particularly the movement that led to the moratorium in 1958 and the limited test ban treaty five years later. Miller ignores the problem of global fallout from the American shots in the Pacific and Russian explosions in Siberia, which provided the primary focus of the nuclear fallout debate of the '50s. It was the massive contamination of the atmosphere from the hydrogen bomb tests conducted by the two superpowers, not the smaller amount from the Nevada atomic tests, that led to the public outcry that finally forced the United States and the Soviet Union to restrict their testing to underground shots.

In *Justice Downwind*, Ball focuses on the impact of the Nevada tests on the 100,000 people in Nevada, Arizona, and especially southern Utah who lived downwind from the test site. This population, Ball contends, received 30% of the total fallout generated by the atmospheric tests conducted at Yucca Flat between 1951 and 1963.

As a political scientist, Ball is primarily concerned with the issues of government responsibility and the legal claims of the downwinders, as he calls them, for compensation. He blames the AEC not only for negligence in the way it conducted the tests but also for deceiving the affected people about the risk of cancer and leukemia stemming from their exposure to the radioactive fallout. In tracing the downwinders' efforts to achieve justice, he praises federal judge Bruce C. Jenkins, who ruled in their favor in 1982, but is critical both of the government's refusal to accept that verdict and of the Congress for its failure to extend legislative relief to the radiation victims of southern Utah.

The key issue is the degree to which the higher rate of cancer and especially leukemia among the 100,000 downwinders can be tied directly to their exposure to radiation from the atomic tests. Ball acknowledges the inability of scientists to prove conclusively that low doses of radiation can cause cancer in humans, but he endorses the views of Chase Peterson of the University of Utah Medical School, who told a congressional committee in 1979 that "scientific proof will never be 100%, and you should not be looking for it" (p. 138). Instead, Ball argues that there is a large enough body of statistical and epidemiological evidence to establish "highly significant associations between the fallout and the ensuing cancers and leukemias" (p. 200).

Although Ball too often pleads the case for the downwinders, he does succeed in showing how irresponsibly the AEC acted at the height of the Cold War. The ultimate irony is that the people most affected, the largely Mormon population of the small towns of southern Utah, were staunchly patriotic citizens who believed that the Nevada tests were necessary to maintain American nuclear superiority over the Soviet Union in the 1950s. They were forced to pay a high price for this belief.

ROBERT A. DIVINE
Department of History, University of Texas, Austin, TX 78712

Books Received

Adolescent Abortion. Psychological and Legal Issues. Report of the Interdivisional Committee on Adolescent Abortion, American Psychological Association. Gary B. Melton, Ed. University of Nebraska Press, Lincoln, 1986. viii, 152 pp., illus. $17.50. Children and the Law.

Advances in Plant Pathology. D. S. Ingram and P. H. Williams, Eds. Vol. 4, Genetics of Pathogenicity Factors. Application to Phytopathogenic Bacteria. Arun K. Chatterjee and Anne K. Vidaver. Academic Press, Orlando, FL, 1986. xvi, 224 pp., illus. $51.

Advances in the Psychology of Religion. L. B. Brown, Ed. Pergamon, New York, 1985. xii, 234 pp. $30. International Series in Experimental Social Psychology, vol. 11. From a meeting, Oxford, UK, May 1982.