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While completing a book on competition (*Competition,* Chapman and Hall, 1989), I came across some disturbing data on the teaching of competition in community ecology. I believe they are serious enough in their implications that they should be brought to the attention of all of us who conduct research and teach in the area of ecology.

When we teach we can lead students to believe that topics are unimportant simply because we ignore them. Table 1 shows the impression transmitted to students regarding the relative importance of competition, predation, and mutualism in organizing the biosphere. Table 1 suggests that mutualism is unimportant compared to competition or predation.

Reflecting on this impression further, it seems hard to believe (even if it does help sell books on competition). Consider. Each cell in our body is possibly a symbiotic association of prokaryotes (Margulis 1970). A large proportion of the world's biota is made up of multicellular organisms—a largely mutualistic association of unicellular components. We all breathe oxygen made by plants. Studies of mycorrhizae suggest that plants are often joined by extensive mycorrhizal networks. All multicellular organisms have endosymbionts in their guts, which may assist with digestion and/or manufacture vitamins. Many plants require insects for pollination and seed dispersal. Predators kill herbivores, which otherwise would eat plants. (At this point, I have convinced myself that I should have written a book on mutualism, and *Bulletin* readers have probably concluded that that is what they should buy.) The data are clear (see also Boucher et al. 1982). Yet the view apparently shared by writers of ecology textbooks, and the impression we consequently give to our students, is that mutualism is relatively unimportant.

In *Competition* I offer five hypotheses to account for these data. Most center on the idea that scientists are heavily influenced by their culture (consciously and subconsciously) when they decide scientific questions are "interesting," and when they select models to describe nature. Toffler (1984), for example, observed that during the machine age scientists tended to generate machine-like models of nature. Prigogine and Stengers (1984) state "... many scientific hypotheses, theories, metaphors and models (not to mention the choices made by scientists either to study or to ignore various problems) are shaped by economic, cultural, and political forces operating outside the laboratory."

I won't review the five hypotheses further here because I don't want to distract from the data themselves. However, they suggest that with respect to research in ecology, we may be projecting our own cultural biases upon nature rather than studying forces in relative proportion to their importance in nature itself. (I review some examples of this in *Competition.*) As ecology moves into the 1990s it is surely important to rectify this by choosing research questions, and strategies according to objective criteria.

With respect to teaching, we may be stuck in a positive feedback loop where people study competition because that's what they were taught, and they teach it because that's what people write about. Even if we as professors

Table 1. The impressions given to students regarding the importance of the three major ecological interactions in the biosphere, as assessed by the number of pages on the topic referred to in the index of current textbooks on introductory ecology.

Textbook	Mutualism	Competition	Predation
Colinvaux (1986)	1	33	70
Collier et al. (1973)	0 (1)*	45	30
Hutchinson (1978)	0 (9)	59	6
Krebs (1978)	3	50	32
Lederer (1984)	5	21	4
McNaughton and Wolf (1979)	20	77	71
Odum (1983)	15	17	15
Pianka (1983)	3	74	41
Ricklefs (1979)	3	38	30
Ricklefs (1983)	2	11	14
Smith (1986)	2† (1)	19	24
Whittaker (1975)	5 (9)	18	22

* Number in brackets is symbiosis, which some authors appear to equate with mutualism.
† Mutualism not in index, but present in text.

are too old to change our ways, perhaps we could at least avoid transmitting these same biases to our students.

Acknowledgments

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UNIVERSITY ECOLOGISTS AND NATURAL HISTORY EDUCATION IN SECONDARY AND ELEMENTARY SCHOOLS: CASCADING EFFECTS THROUGH LINKED EDUCATIONAL LEVELS

I agree with Feinsinger (1987) that local natural history (including ecology) should be taught regularly to elementary and secondary school children. He proposed several ways that university-level ecologists could contribute in this area, such as the development of educational materials for school systems, and training volunteer workers from the community. In this short paper, I add to the discussion of this topic by proposing another important way in which ecologists at universities and colleges can contribute. Unlike Feinsinger, however, I emphasize a strategic approach to the problem, one which recognizes the linkage