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PATTERN AND PROCESS IN BIOLOGICAL INVASION

Biological Invasions. Mark Williamson. 1996. Chapman and Hall. London, England. 244 pages. $43.00 (paper).

A cohesive theory of biological invasion has been frustratingly elusive. If nothing else, Mark Williamson's book, *Biological Invasions*, has convinced me of the futility in looking for broad patterns among the widely disparate creatures that have invaded almost every conceivable environment.

The heart of his book, as Williamson says on page 2, is a table of 10 "Conceptual Framework Points," which are best described as very general statements about the kinds of organisms that invade, communities that are invasible, and effects of invasion. For example, the third point states, "All communities are invasible, perhaps some more than others." The remaining points are similarly vague. Four points deal with arrival and establishment, one with mathematical considerations of the spread of invaders, and three with the consequences of invasion, including the genetics of invading species before and after invasion. The last two points cover implications of invasion biology for understanding community interactions and for evaluating the risk of introducing genetically engineered and biological control organisms. The book is organized around these 10 points and offers copious examples and abundant cross-referencing of each. The examples Williamson has chosen to illustrate the points include viral diseases, intentionally and accidentally introduced plants and animals, animals that have invaded new regions without human assistance, and even *Homo sapiens*.

The breadth of examples addressed is both the book's strength and its weakness. Probably no other single volume includes such a cosmopolitan compilation of invasive organisms. On the other hand, one wonders if such breadth does not to contribute unnecessary confusion. Is it really valid, for example, to discuss a virus, whose existence depends on its ability to invade new organisms, in the same context as a plant that has by happenstance found itself in a new and favorable environment? Certainly, implying that the single gene shift that allows influenza to attack a new population is comparable to the genetics of invading multicellular organisms (page 156) requires much more evidence than this book provides.

Readers looking for practical criteria to evaluate the likelihood that an organism will become invasive in a new habitat will not find them in this book. In fact, the take-home message seems to be that relatively few species become "pests" in novel environments (the so-called tens rule: one in 10 species that are introduced will establish, and one in 10 of those that establish will become a pest), but it is nearly impossible to predict which ones will. This view forms a minor theme throughout the book, that introduction of genetically

engineered and biocontrol organisms should be undertaken with great caution. The "tens rule" has been taken to task by Kowarik (1995, pp. 15-38 *in* Pysek, P., et al., eds., *Plant Invasions -- General Aspects and Special Problems*), although Williamson attributes Kowarik's criticism to problems of semantics. Given the long time lags (in some cases, hundreds of years) evident between introduction and invasion in Kowarik's data for woody plants in Germany, the proportion that become pests would seem to be a moving target.

Williamson's book is not easily read. Part of the difficulty can be attributed to the inherent complexity of the subject. Because the book cuts such a broad swath, it often seems that no one subject receives its due: just as we approach the crux of the issue, it's on to the next subject, with precious little to tie it all together, cross-references notwithstanding. The lack of depth was especially evident in the sections on ecosystem effects; in my opinion, D'Antonio and Vitousek's (1992) article in *Annual Review of Ecology and Systematics* (23:63-87), despite its focus on grasses, provides a much more coherent and complete assessment. The book would have benefitted from some sharp editing, as well. Far too often I found myself re-reading a sentence, trying to decide among two or more possible interpretations. The extensive use of cross-references (which were designated by sub-sections of chapters and were thus difficult to find) certainly relieved the author of considerable composition, but often left it to the reader to decide how the references supported the initial statement. Many times a cross-reference contained yet another cross-reference, leaving the reader slightly dizzy.

The last decade has seen a surge in publications on invasive plants and animals. The journals *Ecology* (77:1651-1697) and *Biological Conservation* (78:1-207) published excellent special features on invasion biology in 1996 (to each of which Williamson contributed). Whereas specialists in theoretical aspects of biological invasion may find Williamson's book of interest, I suspect the review article and special features mentioned above will prove more useful to those with applied interests.--*Diane L. Larson, Northern Prairie Science Center, U.S. Geological Survey - Biological Resources Division, Jamestown, ND 58401.*