



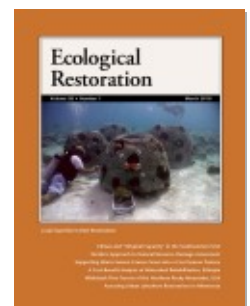
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Invasion Biology (review)

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suggestions about new silvicultural practices that might be adopted by silviculturists with a restoration ecology bent. The implied strategies are more passive than silviculture has traditionally been, showing respect for natural variation at multiple scales. What help is that for a team working to restore a degraded landscape, where some investment is clearly called for? There is limited advice on analyzing treatment responses at finer and coarser scales than treatments are likely to be applied. The chapter also argues for the development of statistical models of forest behavior to support management decisions. The book's emphasis shifts from tools for managing complex systems to tools for better describing them, and this is where the authors fall short. Concluding principles at the end of chapter 5 boil down to the importance of considering more elements than trees, and accepting a wider range of outcomes than the authors believe silviculturists have traditionally accepted or strived for. This is good advice for silviculturists and restoration ecologists alike (and they are sometimes the same people), but it is not really new, as the literature cited attests. In a subtle but important reference near the end of the book, the authors acknowledge that "because of their manipulative nature, many silvicultural studies are better suited than observational studies often used by ecologists to investigate the basic mechanisms of ecosystem responses to treatments or disturbances."

In their introduction, Puettman, Coates, and Messier state that the book "provides . . . a road map to a new philosophical and practical approach to silviculture that endorses managing forests as complex adaptive systems." They do provide a road map to a new philosophical approach (although the novelty may be mainly in contrast to their caricature of silviculture rather than to the rich diversity of current research and practice). As for directions to new practice, I recommend returning to a classic silviculture textbook. As early as 1962, a leading textbook on silviculture told its readers: "Skillful practice itself is a continuing and informal kind of research in which new ideas are constantly applied and old ideas tested for validity. The observant and inquiring forester will find many of his questions about silviculture answered by the results of accidents of nature and earlier treatments of the forest" (Smith 1962, 2). This is good advice for silviculturists and restoration ecologists alike, whether managing for bioenergy production, ecological restoration, or some other social need.

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Invasion Biology

Mark A. Davis. 2009. Oxford: Oxford University Press. Cloth, \$120.00. ISBN: 978-0-19-921875-2. Paper, \$55.00. ISBN: 978-0-19-921876-9. 288 pages.

The field of invasion biology has expanded so rapidly over the last decade that the standard text (*Biological Invasions* by Mark Williamson, Chapman and Hall, London), published in 1996, was outdated within a few years, and instructors were badly in need of a replacement. First off the blocks, aside from edited collections, were J.L. Lockwood and her coauthors with the much-praised *Invasion Ecology* in 2007, and we now have an embarrassment of riches, with Mark A. Davis's *Invasion Biology* (Blackwell, Malden MA). The books target different audiences, however, with Davis's suitable for graduate courses and professional biologists, while the earlier book is more appropriate for an undergraduate course. For a rather slim volume, *Invasion Biology* is rich in insights, examples, and opinions, and it is particularly remarkable because it has three main goals that to some extent are contradictory.

The first goal (chapters 2–6) is a review of research on the academic questions that have dominated modern invasion biology: Why do some introductions lead to damaging invasions while others are innocuous? Why are some species typically invasive while others are not? Are some ecosystems particularly invasible, and if so, why? Why do apparently very similar introductions sometimes have disparate outcomes? Can invasions be predicted? The second goal (chapters 7–8) is an examination of impacts and management procedures, particularly as these may be enlightened by the knowledge developed in the earlier chapters. The third goal (chapters 1 and 9–12) will surely generate controversy: Davis argues that the entire field of invasion biology got off on the wrong foot, and its progress has therefore been severely impeded. His prescription to redress this problem is to call for "the end of invasion

ecology as we have known it" (p. 191) and establishment of a new field, a "neo-invasion biology" (p. 191, but Davis sees this as only a placeholder because any name would be illegitimate if it included the term "invasion") that would eventually be absorbed into ecology and evolution and cease to exist as a distinct subject.

The research review, though relatively brief given the voluminous literature, succeeds in tying most of the main questions of the modern field to a small number of more general phenomena. Most intriguing is a new visual metaphor, the "invasion cliff" (chapter 6), relating invasion pressure (the probability in a specified period that a particular system will be invaded by a particular species) to the number of individuals in an invasion event and the probability of establishment by an individual propagule. The latter probability is determined by traits of the species in question and of the target ecosystem. With simple calculations and three-dimensional diagrams, Davis shows how very minor changes in propagule size or probability of establishment can transform probability of invasion from nil to almost certain. Further research will determine if puzzling observations in the invasion literature (certain disparate outcomes, for example, or lag times between establishment and invasion by introduced species) can be explained in this way.

The literature review is perceptive and critical, and constitutes a good summary of the current state of knowledge on a number of contentious issues—for example, the accuracy of climate-matching models used to predict ultimate geographic range of invaders, and the validity of the EICA ("Evolution of Increased Competitive Ability") hypothesis for relative performance of invaders in their native and new ranges. Davis, a plant ecologist, is particularly convincing in his discussion of plant invasion biology, and his explanation and development of the hypothesis (of which he is one founder) that resource fluctuations explain many plant invasions breaks new and important ground. Though plant examples are more prominent and fully explored, Davis includes many well-chosen examples and discussions of animal, microbe, and pathogen invasions.

The two chapters on invasion impacts and management are good and concise summaries of major bodies of literature. Evolutionary impacts such as hybridization are treated separately, as part of chapter 5. As in the research review, Davis has assembled many apt examples of impacts and management approaches, and they are not all the chestnuts that every invasion biologist (or at least every North American invasion biologist) knows and trots out for undergraduate classes and general audiences. He draws especially heavily from the international literature, and even the most expert reader will find many nuggets among the references, which number well over 1,000 (ca. 1/8 of the book). Davis discusses economic, public health, and ecological impacts, and among the latter, his treatment of impacts at the ecosystem level is particularly engaging

and instructive. The hallmark of these two chapters is a rigorous, thorough overview in surprisingly few pages.

Davis's advancement of his third goal—reshaping, perhaps renaming, and finally burying invasion biology—is probably less successful, though only time will tell. His devotion to this goal colors the entire volume and will attract attention. Although begrudgingly recognizing that his attempt to expunge "invasion" from invasion biology terminology is quixotic (he almost apologizes for titling his book *Invasion Biology*), from page 2 onward Davis struggles mightily for this cause. He also inveighs against the use of the dominant metaphors in invasion biology. There must be good metaphors ("invasion cliff" presumably is among these), but Davis feels that such terms as "invasional meltdown" and even "invasion biology" are so tainted by military connotations that they becloud the biology of the situation. The metaphors, in Davis's view, perpetuate an unfortunate dissociation of invasion biology from the rest of ecology (especially the ecology of succession) that he argues was set in motion by Charles Elton's 1958 classic, *The Ecology of Invasions by Animals and Plants*. Further, he contends that value-laden metaphors have caused invasion biologists, and a public misled by them, to have erected a false dichotomy between native, safe, good species and foreign, dangerous, bad species, which in turn has caused researchers, government agencies, and NGOs to waste a prodigious amount of time and resources combating introduced species that are perfectly harmless and in fact indistinguishable in their ecological "behavior" from native species. For many introduced species that are not currently causing substantial harm, Davis advocates the "LTL approach": Learn to Love 'Em. He stops short of accusing today's invasion biologists of being xenophobes and racists, though he seems to indict most of them for "distinct nativism tendencies" (p. 165). He is at pains to cite writings of sociologists, philosophers, ethicists, and others outside the field who have implied worse, and he urges invasion biologists to acknowledge and emphasize the importance of their contributions.

As part of his argument that harm caused by introduced species is overblown, Davis takes particular aim at the widely bruited view that biological invasions are the second greatest threat to survival of imperiled species, after habitat destruction. Although acknowledging that the authors of the paper leading to this claim (D.S. Wilcove et al. 1998, *BioScience* 48:607–615) scrupulously stated the limitations of the data they examined and the restricted geographic region they were discussing, Davis holds them responsible for framing their paper in such a way as to induce hyperbole in readers. In fact, invasions rank much lower as a threat in some tallies; Davis cites one, for Canada, that lists them as sixth out of six categories of threat. He does not cite others that, independently of Wilcove et al., rank them higher (e.g., *Threatened Birds of the World*, 2000; O.E. Sala et al. 2000, *Science* 287:1770–1774).

For an author who sees invasion biology as overly prescriptive, Davis is pretty preachy. He lists the key research priorities, has particular advice for young ecologists about how to study invasions, tells invasion biologists that they are insufficiently self-reflective and should pay more attention to other branches of ecology and other sciences in general, and advises them on how to design their studies (they should be more integrated into studies of community change) and how to write their papers (avoid martial metaphors and use descriptive terms and choose keywords that will turn up in searches by non-invasion biologists). It is a tribute to Davis's skills as a writer that these admonitions are lively rather than boring. Whether they are convincing and will lead to major changes in the field is another matter. Invasion biology is a young field; although antecedents abound in the 19th century and Elton's 1958 monograph is often cited as a founding document, the modern field really began in the 1980s, particularly spurred by a program of SCOPE (the Scientific Committee on Problems of the Environment), as described by Davis. The growth of the field in just 25 years has been explosive (darn! a pesky military metaphor!), reflected in journals, textbooks, edited collections, popular books, and conferences. Davis does not provide quantitative data to support his claim that progress has been hindered by undue dissociation from other branches of ecology and other sciences; it is simply an assertion. To some extent, the claim of little progress is belied by the substantial achievements that Davis himself outlines in chapters 2–8. Surely it is unlikely that so many scientists, including graduate students, would have been attracted to the field if they did not sense it was dynamic, progressive, productive, and important. It is probably an untestable hypothesis, but I question whether, had the study of non-native species developed, instead of as invasion biology, as SPRED (Species Redistribution) ecology (Davis's preferred alternative, and his choice for a neo-invasion biology), we would today understand the mechanisms and impacts of these geographic range expansions better than we do.

I suspect it is also improbable that Davis's pleas for change will have much of an immediate influence on the discipline. Change will be evolutionary, as it is most of the time in the sciences, and so long as the scientists and students pursuing invasion biology feel they are making progress asking the kinds of questions they are asking and using the methods they are using, there is unlikely to be a great shift in the field. As in any science, new technologies (for example, GIS, molecular genetics) will be incorporated, but whether this will lead any time soon to Davis's desired outcome—the absorption of invasion biology into ecology and evolution, and its disappearance as a distinct discipline—is another matter.

With respect to the management and management-oriented research that constitute a large part of invasion biology today, it is hard to imagine most practitioners who perceive serious ecological or economic damage from

particular invasions suddenly learning to love 'em. Davis is correct that many introductions are not now substantially harming any human interest, but managers have long strived to prioritize actions and allocate resources toward dealing with just those that are most damaging. That there is still an enormous amount of management activity, in spite of explicit or de facto triage, means there is an enormous amount of real damage, and advocating an attitude change will not change that. In addition, one of the very few real lacunae in the research review of *Invasion Biology* is relevant here. Davis devotes scant attention to the well-known phenomenon of lag times, the sometimes mysterious delay between the arrival of a species in a new site and its invasive spread. The predecessor volumes by Williamson (1996) and Lockwood and others (2007) recognized the causes of lag times as one of the intriguing and key questions in the field and explored research findings in some detail. Davis gives such lags a few passing references. Yet the existence of such lags is one of the major stumbling blocks to effective prioritization of management activities and a prime reason why managers are often uneasy about leaving 'em alone, let alone loving 'em, when new species arrive but do not appear to be causing problems. The fact that some species (such as Brazilian pepper in Florida) have appeared innocuous and restricted for decades before spreading rapidly across the landscape should give pause to anyone claiming that a particular introduction will be inconsequential.

In sum, graduate students and researchers in invasion biology have much to gain from reading this book; it is an excellent high-level introduction to current scientific understanding of invasions. The exhortations to reform or dissolve the field will interest any reader and could easily be the basis for a challenging graduate seminar.

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Forests Forever: Their Ecology, Restoration, and Protection

John J. Berger. 2008. Chicago: Center for American Places and Forests Forever Foundation. Cloth, \$49.50. ISBN: 978-1-9300-6651-9. Paper, \$27.50. ISBN: 978-1-9300-6652-6. 306 pages.

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