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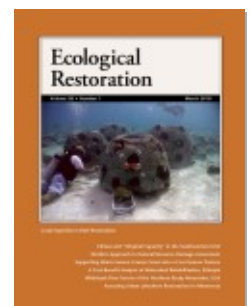
## A Critique of Silviculture: Managing for Complexity (review)

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exceeded the land's long-term carrying capacity. The final chapters hail the exodus of inappropriate mythologies and the emergence of a new lifeway and land-use ethic. Manning is a master of seeking out obscure information about historical characters, both well known and less known.

The book is infused with Manning's distaste for inappropriate "learned legacies" of ranching and farming. This aversion leads to the final chapter, "A Beginning," in which he lays out a different vision, one focused less on exploitation and more on conservation. This particular vision sees fewer permanent human inhabitants, less obsession with profit, and a greater appreciation for large native animals roaming freely. From this focus comes the title of the book.

Manning is a marvelous writer. His talent for seeking out the sensational, the outlandish, and the reprehensible in human behavior carried me through a litany of real historical characters, little known facts about their lives, and the desperate land-use legacies they spawned. As with the best of nonfiction writers, he teaches by telling stories and not by preaching sermons.

The parts of *Rewilding the West* that I found most disconcerting were where Manning superimposed his own judgments and interpretations on the historical and ecological records. Said another way, Manning's judgments of the proper places of people and their lifeways in the Breaks occasionally interrupt his historical narratives that tell the same story better. Misguided interpretations of ecological phenomena form the basis for some of his judgments. Perhaps most prominently, his notion for "restoring" the Breaks to their early historic condition, elaborated in the last two chapters, is informed in part by long-accepted dogmas of succession theory and coevolution.

What are succession and coevolution? Early in the 20th century, the plant ecologist Frederic Clements proposed that a given ecosystem naturally proceeds from bare ground or disturbance through a predictable sequence of successional stages toward a stable, relatively undisturbed climax condition. Moreover, he thought ecosystems consisted largely of coevolved species. Until the last few decades, most ecologists have considered the climax, that is, early historic condition, to be the "gold standard" for ecosystem restoration.

At about the same time that Clements's ideas were shaping land management, H.A. Gleason proposed an "assembly" theory of community development. He theorized that ecosystems were composed of somewhat random and constantly changing assemblies of species. Most scientists of the day climbed on Clements's bandwagon and ignored Gleason. But today, a growing cadre of ecologists, given recent discoveries that nearly all ecosystems are far younger than their constituent species, agree that assembly is the more appropriate paradigm. On this basis, restoring communities based solely or primarily on assumed coevolution of species makes little sense.

Despite clinging to an outdated paradigm, Manning makes a convincing argument that replacing cattle with bison and prairie dogs, and ranching with ecotourism, make sense. Without subsidies, ranching as historically practiced cannot survive economically. Beyond ranching, what are the options? We may have to decide on the basis of personal preference; without a generally accepted "baseline" ecosystem as a target, reaching consensus may be difficult.

Some scientists recently have proposed a restoration venue for North American ecosystems based not on an early historic state but on what existed 15,000 years ago in the late Pleistocene. Humans with their penchant for overexploitation had not yet arrived. Dominant in such ecosystems were the megafauna, now mostly extinct but with extant "surrogates" such as Old World elephants, camels and horses. Pleistocene rewilding goes beyond the imaginings of Manning, and to my knowledge has not developed a large following.

I believe *Rewilding the West* will find audiences among historians, ecologists, land managers, and many lay readers of western prose. Its brevity, readability, and general authenticity contribute to its attractiveness. Those interested in the human history, natural history, and nontraditional possibilities in the American West will want a copy.

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### **A Critique of Silviculture: Managing for Complexity**

*Klaus J. Puettman, K. David Coates and Christian Messier. 2008. Washington DC: Island Press. Cloth, \$60.00. ISBN: 978-1-59726-145-6. Paper, \$30.00. ISBN: 978-1-59726-146-7. 206 pages.*

To a restoration ecologist, the title of this book offers the best of both worlds: applying empirically rooted, practical approaches of silviculture to restore or sustain complex systems, rich with redundancy and resilience. I think it's fair to say that the authors' goal was to deliver on the promise of their title. Their path to this end is a long and winding one, sometimes frustrating, and in the end, they don't deliver all the title promises.

The Society of American Foresters defines silviculture as “the art and science of controlling the establishment, growth, composition, health, and quality of forests and woodlands to meet the diverse needs and values of landowners and society on a sustainable basis” (Adams et al. 1994). *A Critique of Silviculture* argues that the reality has been substantially narrower, focused on trees to the near exclusion of other forest organisms, on the concept of uniform stands, on an agricultural research model, on stands without sufficient thought about smaller and larger landscape units, and on predictability of outcomes.

The authors begin their argument in chapter 1 going back nearly 2,000 years with a very interesting discussion of the ways that human needs, especially population pressures and shifting (in space and time) demand for wood products, shaped the development of silviculture as a discipline in Europe. They explain the emergence of the concept of a stand, or relatively homogeneous block in the forest, as the basis for management and also as the reason for a tendency to focus management toward single-species, even-aged stands, regardless of natural conditions. For many readers, this will be new material. It’s interesting, for example, to learn that the concept of the stand may have originated from the need to protect regeneration from grazing pressure.

From there, however, the authors focus on a near caricature of silviculture. They admit as much for at least parts of their discussion (see page 88). As the discipline of forestry grew in the United States throughout the 20th century, it necessarily adapted to local conditions, local history, and complex mixtures of species. The work of Roach (1977) and Marquis (1981), for example, specifically addresses the challenges of managing complex mixtures of species with different silvical characteristics and retaining legacy trees after harvest, and Smith’s (1962) widely used silviculture textbook has devoted a growing section to silviculture of mixed stands through several revisions and reprintings. Yet *A Critique of Silviculture* focuses almost exclusively on the silviculture research and practice associated with single-species plantations.

Despite the caricature of silviculture at the heart of the book, the details of the critique will stimulate silviculturists to useful self-examination. It provides vivid descriptions of the ways that language and tradition can shape one’s view of the forest. Some of the criticisms are familiar—the overemphasis on trees to the exclusion of other plants and structures, such as dead wood, and the gap between the uniform conditions sought and used for research plots and the high variability encountered in natural forests. The familiar criticisms are well developed here and are good reminders to those who work to bring change to the forest, whether for wood production, improvement of wildlife habitat, or restoration of fully functioning ecosystems, that the forest is a varied and complex place.

While it is not completely new, I found the section on the unintended consequences of “applying an agricultural approach to silviculture research” to be the most valuable in the book. The criticisms of the ways in which research design can influence or limit scientific thinking apply well beyond silviculture. Later in the book when describing recent large-scale silvicultural experiments, the authors explain how silviculturists and others are working to expand the boundaries of research and analysis methods. They are very critical of research results that focus on mean responses, implying that variability around mean responses is omitted from silvicultural research reports, or even, at one point, suggesting that plot-based sampling is ill-suited to characterizing spatial variability and heterogeneity. It is this kind of overstatement that undermines the potential utility of the book.

One criticism of silviculture, however, may be of particular interest to restoration ecologists. The authors believe that an emphasis on predictability is a shortcoming of silviculture. They suggest that the emphasis on predictability necessarily pushes practitioners to simplify the systems in which they work, and offer examples of transitions from natural to planted regeneration as examples of the negative consequences of a focus on predictability. Unfortunately, the authors fail to adequately address the reality that all work in forests—independent of objectives—involves decisions about the allocation of scarce resources. Without some predictions and measures of variation around those predictions, allocation decisions are essentially wishful thinking. Recognition of the risks of simplification does not have to mean forgoing predictions of response to management actions.

Through chapters 3 and 4, the authors turn their attention, not nearly as critically, to the development of the ecological concept of complexity. The social context of this discussion is the late 20th century evolution of society’s perceptions about forests, especially public forests. The authors adopt attitudes about public forests with a one-size-fits-all zeal, failing to acknowledge the question of whether there are still forests that might be better served by a narrow range of management objectives and treatments:

The focus of silviculture in managed forests should shift toward maintaining a full suite of possible outcomes so that the forest can readily adapt to new and modified conditions created by or following disturbance, be they from human or natural causes, or both. In doing so, silviculturists need to accept that some of the advantages and benefits of the traditional silviculture approach may be lost, and understand that “novel” benefits will be gained, many of which we may not currently anticipate.

These shifts may be very appropriate where the management objective is primarily restoration of degraded landscapes, especially when combined with the authors’ emphasis on measuring more than trees in assessing restorations. The book is frustratingly short, however, on concrete

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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- Susan Stout is a research forester with the United States Forest Service Research Project located in Warren, PA. Her research interests include measuring crowding and diversity in forests, deer impact on forests, silvicultural systems, and translating results from ecosystem research into practical management guidelines for Pennsylvania's forests and beyond. Dr. Stout serves on the adjunct faculty at the State University of New York College of Environmental Science and Forestry and the Pennsylvania State University;sstout@fs.fed.us.*



## 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