



Invasion Ecology, by Julie L. Lockwood, Martha A. Hoopes, and Michael P. Marchetti, 2007, Blackwell Publishers, Malden, Massachusetts, 304 p., paperback, USD 64.95, ISBN-13: 978-1405114189.

Understanding the ecological impact of species invasion in modern ecosystems is critically important to conservation efforts. Humans are the primary agent of non-native species introduction today, but species invasions are also well known from the fossil record and have been correlated with various types of geologic phenomena such as tectonic events or changes in relative sea level. These events resulted in such well-known terrestrial invasions as the Great American Biotic Interchange and migrations across the Bering Land Bridge in the Cenozoic, as well as marine interchanges, including the global spread of the Late Ordovician Hirnantian Fauna. Consequently, great potential exists for studying modern invasion ecology as a key to understanding the dynamics of ancient invasions and vice versa. That potential, however, is not explored in this book.

I began reading the book with enthusiasm. The Great American Biotic Interchange was mentioned in the second paragraph of the first chapter. Excellent, I thought, this might be the kind of text that could be useful to assign students as part of my paleoecology course. Unfortunately (from a paleontological perspective), within the same page, the authors dismiss the geologically mediated invasions recorded in the fossil record as useful analogs for modern invasions, since modern introductions are mediated by humans and those in the fossil record were not. While this was a disappointing opening premise for me, since my research examines ancient invasions as a method to predict long-term effects of modern invasions, their viewpoint makes sense when the objective of the book is considered.

The goal of *Invasion Ecology*, as stated by the authors, is to provide an overview of the invasion process from the viewpoint of applied ecology. Their intention is to address the invasion process from the standpoint of economic impact and management practices—clearly a critically important aspect of invasion biology, which is currently underexamined. The emphasis on the applied aspect makes this text an excellent source of information for modern ecology students, but this approach emphasizes precisely aspects of invasion biology that are least applicable to the fossil record.

Although the overall emphasis is on applied ecology, the authors' primary thesis is that species invasion can be best understood and managed when examined within a process approach. The process approach provides an excellent framework for considering each stage of invasion separately and is equally useful when considering ancient invasions as it is for modern ones.

The book is organized into twelve chapters that follow the process of invasion outlined in Chapter 1. Chapters 2 (Transport Vectors and Pathways) and 3 (Trends in Numbers of Invaders) examine the initial introduction of non-native species into a new ecosystem via various transportation vectors. Since this section examined only human vectors, this is the least directly applicable section to the fossil record but does provide interesting points pertinent to ancient invasions. For example, most successful transportation events involve larval or juvenile individuals; furthermore, certain life history characteristics, such as being a generalist or having planktic larvae, will generally enhance species establishment. Chapters 4–6 (Propagules; Disturbance; Establishment Success) focus on factors controlling the establishment of a viable population, including the number and size of propagules (or number of introduced individuals) transported. Analogous processes likely affected the successes of ancient invasions. The process of geographic spreading, or range expansion, is addressed in Chapters 7 (Modeling the Geographical Spread of Invasive Species) and 8 (Ecological Processes and the Spread of Non-Native Species), which include various mathematical models for assessing this invasion stage. The types of data employed (e.g., geographic range size and population density) can also be extracted from analyses of fossil communities.

Chapters 9 (Ecological Impacts of Invasive Species) and 10 (Impact Synthesis) focus on the ecological impact (largely economic) of invaders and synthesize the points from the previous chapters. The synthesis chapter is excellent, and as a stand-alone entity is definitely a worthwhile read for paleontologists interested in issues of species invasions, whether in the modern world or to stimulate thoughtful consideration of the application of these modern processes to the ancient record. Chapter 11 (Evolution of Invaders) examines evolutionary changes that have occurred in invasive populations relative to their native ranges, which is an important concept when studying ancient invasions. Finally, the book concludes with a chapter examining modern invasion prevention and eradication procedures—or sometimes the lack thereof (Chapter 12: Prediction, Risk Assessment, and Management of Species).

The book is an excellent synopsis of the current field of invasion ecology and contains a large reference section with over 600 papers cited. Numerous examples and graphs derived from the primary literature support each chapter, and some of the most critical information is often presented within concise

call-out boxes. In addition, each chapter concludes with a short list of (six to twelve) additional papers that either serve as companions to the points made within the chapter or address additional complexity within the topic. As a result, this book is an excellent information source for paleontologists who wish to learn more about the invasion process and current theory in invasion biology.

In summary, *Invasion Ecology* is very effective at achieving its goals: to place invasion ecology within a process framework that emphasizes applied aspects of the field. As such, it is an excellent text for ecology students and those paleontologists who would like to learn more about this aspect of invasion biology. The book does not provide an overview of invasion theory, although it references many sources that do provide such an overview. For example, it does not have lists of characteristics

that promote or inhibit invasion success—if fact, the wealth of examples provided suggests that there are no universally applicable lists of this sort. The text explicitly excludes any invasion processes that are not human mediated; therefore, many of the examples and conclusions cannot be applied directly to the fossil record, but if one is prepared to wade through a dense, but enlightening, text while creatively considering how these concepts could be applied to ancient invasions, then tackling this book is a worthwhile endeavor.

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