Spatial analysis and modeling is one of the fast developing, albeit often confusing and challenging, research areas in ecology. The reason lies in the fundamental pursuit in ecology, that is, to search for relationships between pattern and process, including spatial pattern. With spatial analysis and modeling, we stand to gain much insight and improvement in our understanding and ability to predict dynamics of ecological systems. Thus, it is imperative for ecologists to better understand the concepts and methods of spatial pattern analysis. This is the goal of a volume in the Cambridge Studies in Ecology, “Spatial Pattern Analysis in Plant Ecology,” by Mark Dale.

Dale’s book is a review that not only describes and evaluates methods of spatial pattern analysis, but also discusses the concepts on which the methods are based. The book has nine chapters. The first three chapters define the concepts, the sampling strategies for collecting spatial data, and the basic, one-dimensional methods to study spatial distribution of a single species, respectively. These chapters lay the foundations for the remainder of the book. Chapters 4, 5, and 6 expand the basic methods to the analysis of two or more species and two-dimensional patterns. Chapters 7 and 8 describe distance-based methods with point data and environmental gradients. The final chapter summarizes the recommendations for the use of different methods and discusses future directions of spatial pattern analysis. Dale draws on many insights and examples from his own work to illustrate a full range of methods.

The great strength of the book is found in its first and last chapters. In the first chapter, Dale gives an excellent review of basic concepts that I recommend to everyone who is interested in spatial pattern analysis. The most challenging problem for ecologists is not a lack of efforts or opportunities to perform spatial pattern analysis, but a lack of understanding about why it should be done and how it can be done effectively. Often, quantitative description of spatial pattern is treated as an end itself, rather than the first step toward the fundamental goal of establishing relationships between pattern and process. In the last chapter, Dale discusses future research directions by posing three groups of ecological questions pertaining to spatial pattern analysis. For example, about relationships between spatial pattern in vegetation and the environment, he asks: “To what extent do the spatial patterns of environmental factors, such as soil nutrients, determine the spatial patterns of plants? To what extent are they themselves determined by the past plant pattern and how long does the effect persist?” These questions should help the reader reevaluate research priorities and develop testable hypotheses.

The major weakness of the book is that few examples are used to elucidate what insights into relationships between pattern and process have been (or could be) gained through spatial pattern analysis. In essence, the author fails to act on the conceptual discussions in the first chapter on why spatial pattern needs to be studied. Spatial pattern analysis is of limited value if we do not strive for explanation and prediction of changes in ecological processes caused or reflected by changes in species distribution. The book also has some minor problems. The method chapters of the middle section lack clear organization, and may be somewhat confusing to the reader. The frequent use of acronyms like “3TLQV” and “PQV” is distracting, even though a glossary is provided. In addition, the book does not consistently offer discussions on the caveats of, or comparisons among, different methods, which may be what the reader needs the most.

To review a “review book” on quantitative techniques, one has to consider two questions: First, does the new book have any advantages over the existing treatises on the same subject? Second, is it a useful reference book for the readership of Forest Science? Notwithstanding the shortcomings, my answer to the first question is positive. Even more experienced researchers should find the conceptual framework discussed in the first chapter refreshing and the ecological questions posed in the last chapter intriguing. However, my answer to the second question is less positive. The book has a narrow focus on methods of species distribution. Most of the techniques are classic methods in spatial pattern analysis and do not apply to today’s resource management problems, for which the methods that reflect landscape ecological perspectives may be better suited. As a result, many professionals in forest management may not find the book very useful. Overall, the book is well written and provides a valuable reference for graduate students, researchers, and teachers of plant ecology interested in spatial pattern analysis.
Ecophysiology of Northern Spruce Species: The Performance of Planted Seedlings


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This book arises from the increasing need to improve forest productivity both economically and efficiently. Preserving more of the remaining old-growth forests and forests of an ecologically sensitive nature requires improved productivity on a smaller managed land base unless future demand for forest-based products radically decreases. At the moment, such a decrease is not in sight.

The author has estimated that throughout the Northern Hemisphere, over one billion spruce seedlings were planted annually during the 1990s. The book is intended to provide foresters and researchers with a synthesis of available information on the ecophysiological performance of spruce seedlings planted in forest plantations. A good understanding of how planted seedlings respond to applied silvicultural practices is necessary for developing high-yield plantations.

An introductory chapter presents briefly the distribution of the species of concern: black spruce (Picea mariana [Mill.] B.S.P.), Engelmann spruce (P. engelmannii Parry), Norway spruce (P. abies [L.] Karst.), red spruce (P. rubens Sarg.), Sitka spruce (P. sitchensis [Bong.] Carr.), and white spruce (P. glauca [Moench] Voss), and the silvicultural systems commonly applied in management of spruce forests. The following subject matter is divided into five sections. Sections 1 and 2 present basic environmental, physiological, and morphological concepts at a general level. The reader learns, for example, what causes variation in plant responses to day length, and why and how water moves through a plant. Building on the preceding information, Section 3 deals with the ecophysiological responses of spruce seedlings to environmental factors. Section 4 illustrates how genetic variation may affect seedling performance. Finally, Section 5 focuses on seedling responses to regeneration practices. It covers nursery cultural, storage, and handling practices, as well as environmental stress factors and silvicultural practices after planting.

The synthesis is drawn from research done in all areas where spruce is cultivated, even though the emphasis is understandably on Canadian conditions. The author, Dr. Grossnickle, is currently affiliated with Cellfor Inc. in Vancouver Island, B.C., and is an adjunct professor of the University of British Columbia. As the synthesis focuses largely on processes and responses, it is more generally applicable; many aspects are relevant for cultivation of other conifers as well. The literature base is impressive and up to date, even though, for example, the extensive research on spruce published in German is excluded.

A reader will find in this book practically everything that has something to do with spruce seedling performance after planting. What one cannot find is where to plant spruce seedlings. The edaphic site requirements of the different spruce species, and their responses to site quality, are not addressed. Nutrient requirements vary among spruce species: black spruce may thrive on nutrient-poor sites, whereas Norway spruce requires nutrient-rich conditions. Even if one uses high quality seedlings that are transported and planted with the best care, they will not grow if planted on an unsuitable site. Fertilization may, to some extent, remedy this problem, but repeated multinutrient fertilization is usually less economical than choosing a species suitable for the site.

The book serves best as a textbook for undergraduate and graduate level students. It examines the basic concepts thoroughly, and is, for the most part, very clear and easy to read, even for students with English as their second language. Ample reference is given to literature containing more detailed information on specific issues for those who want to delve deeper. The book lacks an index, but is well organized and cross-referenced so, in general, that is not a problem. A drawback of the wide coverage is some minor inaccuracies in some specifics. For instance, I was slightly bothered by the obvious use of “organic soil” in some instances as a synonym for “surface organic layer,” meaning the humus layer. This can lead to some misconceptions, especially concerning the water retention characteristics that differ between a thin surface (humus) layer and “actual” organic soil, such as peat. Black spruce and Norway spruce often grow on peat soils, too. Some attention is specifically given to peatland sites, but not adequately to provide a good understanding of their specific character that differs from mineral soils in several respects.

This well-written synthesis is a welcome textbook for forest regeneration classes at many levels.
If I could slip one book through a time warp, back to the 1970s when I was first trying to “do” science, this would be the one. This useful and insightful book ambitiously presents the fundamental nature of science and how to apply science in ecology (and forestry). Although the title may sound a bit dry, the structure and writing style are sleek and appealing. In this review, I highlight three aspects of the book: its methodological and thorough coverage of the subject, its delightfully balanced view of science, and its practical value for students and scientists. Curious minds will find no better use for $50.

Ford’s philosophy is that “To understand your subject thoroughly, you need to appreciate the philosophies on which its methods are based, their strengths and weakness, and how they are changing.” His approach to teaching this philosophy is to divide the domain of science into four sections: (1) developing an analytical framework, (2) making a synthesis for scientific inference, (3) working in the research community, (4) and defining a methodology for ecological research. These topics are developed through 16 chapters, with titles that range from “The Art of Measurement and Experiment” to “Individual Philosophies and their Methods” to “Criticisms and Improvements for the Scientific Method in Ecology.” Thorough coverage includes visiting the classic philosophers of science (from Aristotle on logic to Zuckerman on gender in science), the classic vocabulary of science (from axiom to why-type questions in a very useful glossary), and the classic steps of science (from observing anomalies to validations). Ford’s overview of quantitative methods (including dynamic systems models) provides the landscape view of how and why these methods are applied to address specific questions. This broad view of the rationale for using quantitative methods is a marvelous supplement to the dull, number-crunching side of statistical analysis.

Thoroughness is matched by a balanced perspective on the entire endeavor of science. For example, Ford asserts “There is no single correct method of science…the individual scientist must make choices about measurements and experiments, deciding on a confirmatory or falsifying strategy, seeking causal explanations, and developing statistical tests for a postulate. What influences these choices?” He also notes, “One reason why some scientists may be reticent to admit to a philosophy (and thereby acknowledge that other philosophies exist) is that it would open them to criticism or lessen the impact of the criticisms they proffer.” A second aspect of balance is evident in the presentation of the roles of creativity and skepticism in science, captured in Ford’s assertion that “Creativity in science can be stimulated by the continuous application of criticism.” The third balancing act of the book is bridging the gulf from somewhat esoteric philosophies of science to the practical issue of “How can I come up with a question?”

The greatest value of the book lies in its straightforward presentation of how one goes about doing science. Practical insights on developing research questions and experimental designs are illustrated with more than a dozen detailed examples. Students will appreciate Ford’s reporting of the creative process behind a M.S. student’s thesis project on wildlife and coarse woody debris in riparian zones (how did she come up with the general area of investigation? How did she narrow it down to a workable, thesis-sized project? What would she have done differently with the benefit of hindsight?). More sophisticated structure is developed with a case study of pollen records of black and white spruce migrations across Alaska, where a theory network is elaborated to lead from observations of pollen distributions to inferences about climates over millennia. The usefulness of the book is further developed in two chapters that examine the culture of science, with explicit discussion of how the literature develops and influences science, how research is funded, and how peer review operates.

This book is simply a clear and readable exposition on the nature of science and research and how one can join the wonderful search for knowledge.