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# Spatial Pattern Analysis in Plant Ecology

The predictability of the physical arrangement of plants, at whatever scale it is viewed, is referred to as their spatial pattern. Spatial pattern is a crucial aspect of vegetation which has important implications not only for the plants themselves, but also for other organisms which interact with plants, such as herbivores and pollinators, or those animals for which plants provide a habitat. This book describes and evaluates methods for detecting and quantifying a variety of characteristics of spatial pattern. As well as discussing the concepts on which these techniques are based, examples from real field studies and worked examples are included, which, together with numerous line figures, help guide the reader through the text. The result is a book that will be of value to graduate students and research workers in the fields of vegetation science, conservation biology and applied ecology.

Mark R. T. Dale is Professor of Biological Sciences at the University of Alberta, Edmonton, Canada.

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# *Spatial Pattern Analysis in Plant Ecology*

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# *Preface*

This book is designed to help the reader understand the concepts and methods of spatial pattern analysis. The book is divided into three sections of three Chapters each. The first three Chapters lay the foundations of the material by discussing the basic concepts, considerations for the acquisition of data, and the basic methods for a single species in one dimension, concentrating on data from strings of contiguous quadrats. The middle third of the book describes extensions of the basic methods to the analysis of two species, of multiple species and of data used to investigate two-dimensional patterns. The last three Chapters describe different aspects of spatial pattern analysis: point pattern data, pattern on environmental gradients and future extensions of pattern analysis.

The book is written in the first person plural throughout, not as an affectation, but because the material presented here is not the work of just one person, but of a whole group of people who have contributed to the overall research program. That group includes students and associates whose names will be obvious from the citations: Dan MacIsaac, Dave Blundon, Elizabeth John, Maria Zbigniewicz, Rob Powell, Colin Young, and so on. Other students and researchers have allowed us to use their data for illustrative purposes and these include John Stadt and Michael Hunt Jones.

The book does not present the material with a thoroughly consistent notation. This was a deliberate decision, based on the reasoning that a book-wide notation would be forced to be elaborate and thus eventually clumsy. Therefore, it is possible that the variable '$x$' can take on different meanings in different parts of the book. The meanings should be clear within their contexts.

There is a certain amount of redundancy in the material; some equations, for instance, appear more than once. Again, the choice was

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deliberate and based on convenience, to reduce the amount of flipping between pages and Chapters to find the required information.

This volume represents work that is very much 'in progress'. It describes material in a rapidly developing field of research. There is much contained here that really only came to light in the writing of the book itself, and there is obviously much more to be discovered. The emphasis in the description is methodological, in part because that aspect of the subject has the greatest need for exposition in order to encourage researchers to tackle the subject and, in part, because too few studies have been done of many spatial pattern phenomena to allow satisfactory generalizations to be made. Because spatial pattern analysis has close links with other areas of plant ecology, the book could easily have been expanded to include more plant community ecology, more on theories in vegetation science, more on multivariate analysis techniques, etc. The effort was made, however, to concentrate very much on the main topic, but without ignoring the important connections to other areas.

We gratefully acknowledge the technical assistance of Megan Lappi, Nadia Sas, Elaine Gordon, Jiangfen Zhang, Sara Suddaby, Dianne Wong and Marko Mah. P. A. Keddy, N. C. Kenkel, C. J. Krebs, R. Turkington, J. Birks, J. A. Wiens, and an anonymous reviewer provided helpful criticism and suggestions on earlier versions of the Chapters.

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