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BOOK REVIEWS

Marhold, K., Schmid, B. & Krahulec, F. (eds.) 1999. **Ecology of closely related plant species**. 182 pp. Opulus Press, Uppsala. Price: 300 SEK.

The tradition of vegetation analysis in the spirit of Braun-Blanquet is "the classification of species by sites and sites by species." So it is stated in the introduction of this special issue of *Folia Geobotanica*. In this manner do plants reflect the character of their habitats in their adaptations, and in this manner do they create the habitat – the environment to which they and other species must adapt. The articulation of this reciprocal dynamic reflects a severance from the anachronistic perspective of plants as phytometers of the abiotic environment. Until quite recently, the dynamic was perceived as primarily ecological. This book incorporates an evolutionary dynamic into vegetation analysis as well.

How is an evolutionary perspective to be incorporated into vegetation analysis? Micro-evolutionary techniques such as selection analysis, reciprocal transplants or common garden studies could contribute in a straightforward manner to investigations of how plant communities exert selection on different species, and how species respond evolutionarily (genetically) or plastically to such community-induced environmental variation. Historical biogeographic studies could provide explanations for species distributions that cannot be explained by species tolerances and habitat-specific fitness alone. And phylogenetic information can be used to address questions of macro-evolutionary changes in species within plant communities.

These studies of the ecology of closely related species attempt to incorporate phylogenetic information into the analysis of how species adapt to different biotic or abiotic environments and how such adaptations influence species distributions and associations. The stated goal of this approach was to investigate the importance of phylogenetic constraints on species adaptations to their communities. Many of the studies presented in this volume attempted the most preliminary step required for this sort of synthesis, namely to identify the taxonomic units and to describe their distributions and vegetation associations. Some quite thorough descriptions were provided along these lines. Many of these studies were performed *in situ*, and consequently were limited in their ability to distinguish genetically based from environmentally induced morphological differences among the taxonomic units. One notable exception was a reciprocal transplant performed by Flegrová & Krahulec which documented genetically based life-history differences and local adaptation in diploid and tetraploid *Anthoxanthum* species.

Another method whereby several of the contributors were able to avoid the difficulty of establishing the genetic versus environmental basis of variation among populations or higher taxa was by considering chromosome number as the focal character. Studies by Abs, Flegrová & Krahulec, Loidi et al., Michler & Arnold and Wallossek all used this method. This approach also provided phylogenetic information when the progenitor and the polyploid were used in comparison. In all of these studies, the polyploid species were distributionally, spatially, and/or ecologically distinct from their diploid progenitors or from relatives of other ploidy levels. Interestingly, however, there was no consistent pattern to their distributions; in some studies, the diploids had a broader ecological distribution, in others the polyploids and diploids tended to occur in very similar habitats. Only in some studies did the polyploids occur in more competitive areas, as predicted. To determine the mechanism for these distributional differences, experimental manipulations need to be conducted. Although environmental correlates can be measured, one actually wants to know whether different ploidy levels actually perform differently within the habitats of their relatives, and if so, why? Otherwise, the spatial separation and distributional differences may be due to dispersal and colonization limitation as much as to ecological specialization. Historical biogeographic interpretations, such as that of Abs in this volume, that consider the breadth of distribution as a function of the time of origin of the polyploid taxon and the frequency of the habitat type that it inhabits must also be considered when explaining distributional patterns.

Diekmann & Lawesson provide one of the clearest examples in the collection of how replicates of closely related species can be used for empirical tests of theoretical predictions of distributional patterns. They compare the ecological breadth of four species pairs along a latitudinal transect. In contrast to the prediction that plants have narrow niches at the extremes of their distribution, they demonstrated the opposite. The widely distributed species had wider ecological distributions in more northerly locations, presumably due to ecological release. The power of their argument comes from the fact that the pattern was reflected in the four different taxa, suggesting a more general ecological pattern than when shown for a single species pair.

At times, the only phylogenetic information available in a study was that the species were, in fact, closely related. Simply studying the ecology of closely related species does not necessarily provide the evolutionary insight we seek, however. Ultimately, we need to know the evolutionary sequence of speciation, the polarity of adaptations, and the frequency and the distribution of adaptations throughout a clade. Although comparing adaptations of species pairs or complexes offers some insight into the evolutionary lability of a given lineage, it cannot reveal the evolutionary trajectory of adaptations, and consequently cannot determine the true nature of the phylogenetic constraints.

Some of the studies get tantalizingly close to unique evolutionary insight, yet ultimately fall short because of the lack of a reliable phylogeny, the lack of an adequate number of species or clades, or the lack of experimental approaches

that could decouple confounding influences. These studies show clearly how much *could* be gained from the thorough linking of phylogenetic information with vegetation studies. In addition, some of the detailed vegetation descriptions could eventually incorporate experimental micro-evolutionary approaches in order to analyse the hypothesized adaptations of members of the vegetation associations. Explicit tests of the adaptive value of diagnostic characters in different environments or vegetation associations could be conducted, and the role of hypothesized adaptations in limiting or expanding species distributions could be tested directly. The book is full of potential study systems that could contribute to real progress in the study of the limits to species distributions if, in addition to the solid descriptive studies presented here, more experimental micro-evolutionary and ecological approaches were to be incorporated.

The book provides some fine descriptive data on species distributions, vegetation associations, and novel characters, including chromosome number, hypothesized to be adaptations to specific environments. The introduction admirably tied the separate studies into a coherent framework, combining taxonomic and phytosociological studies into an investigation of the nature of phylogenetic constraints on the adaptation of plants to their communities. This is an exciting goal indeed. In practice, however, the studies ultimately revealed how much work is still needed in order to accomplish such goals. For a start, it is good to articulate these goals explicitly. If this collection represents a new synthesis of phylogenetics and vegetation science, then let us hope for its rapid development, as it will surely be a valuable contribution to community ecology and vegetation analysis.

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Mladenoff, David J. & Baker, William L. 1999. **Spatial modeling of forest landscape change: Approaches and applications.** 352 pp. Cambridge University Press, Cambridge. ISBN 0-521-63122-X (hardback). Price: USD 95.-.

This volume is the outcome of a symposium of the same title held at the 1997 annual meeting of the Ecological Society of America. Its stated purpose is to assemble a representative group of approaches being taken in spatial modeling of forest landscapes, an area of research of interest both in ecological science and to landscape management. The scope of the book was deliberately focused, but the editors state that they "attempted to bring together contributors working with approaches and in geographic locations that were as diverse as possible, or could be found through colleagues".

The book consists of 13 chapters by 29 contributors, all but two of whom have home addresses in the continental USA. The chapters are as follows (with their geographic focus, if any): 1. An introduction to the modeling approaches; 2. Modeling tree dynamic and distributions on moisture gradients (Connecticut); 3. Affects of adjacent areas on primary forest dynamics (peninsular Malaysia); 4. Modeling fine scale processes to large-scale patterns (Sierra Nevada, California); 5. Simulating vegetation dynamics using vital attributes (Bryce Canyon, Utah); 6. An object-oriented model of forest disturbance and succession (northern Wisconsin); 7. Predicting fire effects at the landscape scale; 8. Mechanistic models of landscape fire patterns (western USA); 9. Sustainable forest structure in a fire-prone landscape (Sierra Nevada, California); 10. Modeling deforestation in Amazon basin (Rondônia, Brasil); 11. Spatial simulation of human and natural disturbance (Medicine Bow National Forest, Wyoming); 12. Linking timber harvest to landscape patterns (Hoosier National Forest, Indiana); and 13. Summary and future directions. As usual, with an edited volume such as this, there is some unevenness in the style and perspective of the different chapters. Some present summaries of previously published material; others present work in progress. Several describe particular models in detail, including parameter values and algorithm flow charts, and a few provide comparisons of different models or different approaches.

An obvious criticism is that the work presented in this volume, with two exceptions, is highly focused on the northern and western states of the USA, which is not surprising given the affiliations of the authors, but a drawback given the stated purpose and scope. The editors acknowledge that relevant research from outside the USA is not included, to the detriment of the generality of the presentation.

A second criticism is that the first chapter could do more to prepare the reader who is not familiar with the literature for the material that follows. It would be helpful to explain the names and properties of the models at the beginning of the book, some of the material from Chapter 13 would be better placed in Chapter 1. A figure showing the relationships among the models would enable the uninitiated reader to put the various approaches in perspective before going on to read about the individual models, some of which are presented in great detail. A glossary would also be helpful in keeping straight the different approaches as one goes through the various chapters. A minor irritant was the typographic inconsistencies among model names; some are lower case, some upper case, and some are upper case Italic.

Despite these criticisms, the book is a valuable contribution that documents the excellent progress that has been made in this somewhat difficult but very important area of research. As the editors comment, the achievements represented in this volume would have been almost inconceivable two decades ago. Even the chapters that present work in progress provide insight for the reader into the development of the field. The book will be a valuable resource for workers in the area, but also provides material of interest to a more general audience of ecologists. An important theme that is evident in this volume is the growing understanding of the importance of scale in these models and of the complexities of dealing with multi-scale phenomena using explicitly multi-scale approaches. The presentation is enhanced by numerous figures, including some very impressive examples in color.

This volume presents the remarkable progress that has been made in forest landscape modeling, but much of the work is still at a very detailed level; many of the models are