Pigeonholing plants

Plant Functional Types: Their Relevance to Ecosystem Properties and Global Change

edited by T.M. Smith, H.H. Shugart and F.I. Woodward

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There are some quarter of a million species of flowering plants. If one is studying quadrats on a university campus, the flora may be restricted enough that one can easily use names, but as the scale of the study increases this rapidly becomes impossible. (Even Darwin did not try to identify plants collected on his voyage, but left the task to a generous botanist[1].) Consider then the problems faced by earlier biogeographers and more recently by ecologists who have tried to model global vegetation. Species names become useless and simplification becomes the challenge[2,3]. Plant ecologists have been forced to resort to classification based on functional types.

There were three questions that I wanted answered by this book. First, how has the discipline relating to plant functional types evolved over the last century? I wanted treatment of early systems such as that of the plant geographer von Humboldt, to make sure that contemporary workers were not passing off old ideas as new ones. Second, what traits are best for such a system? Early workers like von Humboldt had already identified traits for growth form and Raunkiaer systematized this using only one trait: the placement of winter buds. So long as we use morphological traits alone, we are forced simply to re-sort the traits used a hundred years ago. Over the past few decades, Phil Grime has introduced a whole new approach by introducing the method of screening large numbers of species simultaneously for physiological traits. This has the potential to revolutionize the designation of functional types, but morphological traits continue to dominate many schemes. Third, what systems currently exist and is there consensus on which is best? How does the best current system compare with earlier ones, is it a real improvement and, if so, how does it relate to more recent work?

In one of the introductory chapters, Gitay and Noble ask 'What are functional types and how should we seek them?' They begin 'In *recent years* [my italics] ecologists have placed increasing emphasis upon the use of non-phylogenetic classifications of organisms when describing the structure and functioning of systems.' They then launch into work mostly from the 1980s – with the exception of a passing remark about Theophrastus. Apparently von Humboldt, Raunkiaer, Du Rietz and Dansereau neither existed nor had anything useful to say. In the second introductory chapter, Shugart begins with the importance of simplification in order to study systems. This too is an important idea, but again I also, although I happen greatly to like Shugart's gap regeneration model, and enjoy his writings on this topic[4], the connection between functional types and gap replacement is not strong and has already been well covered in books a decade old.

Turning to Woodward and Kelly's chapter, the lack of historical context again occurs, although there are some new results – such as the quantitative relationships between uptake rate of nitrogen, maximum rates of photosynthesis and mycorrhizal association. A single figure on these relationships made me feel that I had my money's worth from the chapter, although it was not stated whether the data were measured in the field or in the lab, which is a fundamental distinction when screening for life-history traits. In Westoby and Leishman's chapter I finally found some introduction to functional types that at least mentioned von Humboldt and Du Rietz; it was, alas, somewhat superficial. A student could read this entire book without seeing the actual Raunkiaer scheme. By the time I was halfway through the book, I was getting somewhat irritable.

Other papers had superfluous data – showing, for example, community biomass in different tundra types; rates of decomposition of leaf litter from tundra plants; net primary productivity of creosote bushes; leaf water potential averaged over several years; and full-page plots of the number of *Bouteloua gracilis* plants alive over a 50-year period. Finally, Leeman redeemed the book considerably by introducing the topic of global vegetation models under different climate scenarios. This was accompanied by fine colour pictures – the sort that would make useful overheads for teaching.

In assessing coverage of contemporary research, I had two reference points: deserts and wetlands. In the case of deserts, early workers like Kearney and Shantz have been supplemented by Cody and Nobel, and are making real progress in classifiying life-history types (see also Ref. 5). If these were mentioned at all, I missed them (although Sala, Lauenroth and Golluscio did present some work on the relative abundances of succulents, grasses, shrubs and forbs, and the factors that may control them). With respect to wetlands, early workers like Sculthorpe presented detailed life-form classifications. More recently, van der Valk's model for wetland succession was a quantum leap of sorts from Sculthorpe, yet I do not recall a reference to it at all. My own work on wetland functional types[6] was considered only superficially. Students could certainly read this book without being aware that functional classification schemes for deserts and wetlands are available.

In conclusion, the book was unable to address the three questions I needed answers for regarding plant functional types. I had to turn to other books for help[5,7–9]. Social commentators have fretted about the growing tendency towards short-term memory and lack of historical context – a sort of cultural Alzheimer's disease. Computer databases tend to reinforce this because papers that are on line tend to be no more than a few decades old. Yet book authors must provide the historical foundations for modern work. In this case, no one could provide a significant improvement on the simplicity and efficiency of Raunkiaer's system of plant classification. As an editor myself, I have been frustrated by the reluctance of many authors to write about their discipline as opposed to themselves. Writers and editors must become more aware of their responsibility to cover the entire discipline.

In many ways this is an acceptable book, but I finally figured out my basic reason for disappointment. The book is called *Plant Functional Types*. If, for comparison, the book had been about London, I would have expected something on the history of the city, some maps, a treatment of the most significant sites and discussion of newer developments. Instead, we have been given tours of the authors' homes. Some of the writers have convinced me that they have very fine homes indeed, but we could have expected more about the entire city.

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