Book Reviews

Plant Growth and Climate Change. James I.L. Morison and M.D. Morecroft (eds.). 2006. Blackwell Publishing Ltd., Oxford, UK. 213 pp. List price $212, hardbound. ISBN: 9781405131926; ISBN10: 1405131926.

The book is well organized into independently authored chapters, each addressing a major theme connecting plant growth to a primary environmental factor: temperature, CO_2, water, nitrogen. As one would expect from diverse teams of authors, chapters vary in clarity of discussion and written tone. Most authors achieved an admirable degree of synthesis around concepts that are neither simple nor necessarily straightforward. There is substantial reliance in some chapters on self-citation; sections vary in the balance between comprehensive review and the authors' own data. As a whole, the text is a useful compilation for the researcher seeking a focused survey of this series of topics, but the book's retail price would make it very difficult to justify it as a required text for graduate students.

Chapter 1, "Recent and future climate change and their implications for plant growth," provides a solid contextual framework for the remainder of the book. Adequate definitions of terms are included for the nonspecialist, although given the number of acronyms, it would have been helpful to have included a unified list in addition to the initial in-line definition. The discussion addresses directly the limitations inherent in global circulation models and rightly cautions about application of climate predictions with respect to smaller spatial and temporal scales. Supporting graphics are useful.

Chapter 2, "Plant responses to rising atmospheric carbon dioxide," was a bit heavy on jargon and thus reads as though written particularly for specialists in the same discipline. The prose was less clear than that in other chapters. The discussion reads like a cataloguing of results collected from the literature and emphasized the authors' own results; greater synthesis would have made the chapter more valuable to the reader.

Chapter 3, "Significance of temperature on plant life," achieved an excellent broad synthesis of existing knowledge with appropriate citation of seminal literature, written clearly for comprehension by professional and advanced student alike. The chapter is quite useful in that the author connected major paradoxes and themes to the context of climate change but without resorting to the temptation of prediction, acknowledging limitations of large-scale models and cross-temporal scaling. Particularly valuable is clarification of certain misconceptions about temperature responses of plants, accompanied by cogent explanation of the correct context within which to interpret data in the literature on the coupling between temperature and plant growth. Both natural and managed (agricultural) systems are addressed.

Chapter 4, "Temperature and plant development: phenology and seasonality," summarizes existing databases on plant phenology and offers a brief catalog of results from recent literature to point out heterogeneity in observed phenological responses. The question is addressed of how one might utilize phenological measurements as biological indicators of climate under a caveat of presupposing "precise quantitative analysis of changes in phenological time series and a known relationship with temperature." More emphasis is on natural than managed systems because of the difficulty in teasing out superimposed effects of human management on temporal variations in climate. Highlighted are pitfalls in common approaches to attributing changes in phenology to temperature or any number of other plausible explanatory variables. The authors propose development and adoption of non-parametric, Bayesian analyses in place of traditional trend analysis by linear regression. The chapter is fairly heavy on self-citation.

Chapter 5, "Responses of plant growth and functioning to changes in water supply in a changing climate," underscores the premise that under climate change, the amount and seasonal pattern of rainfall is expected to have higher variance than today; hence, concern arises about disruption to food production systems because of drought or excess water. Illustrative examples are drawn substantially from annual and perennial cultivated systems. Recent proposed theories for hydraulic functioning of plants under water limitations are presented, particularly from crop systems where there may be avenues to maintain yields while using substantially less water. Basic processes are reviewed, including root growth from the cellular level and the resistance to water flow into roots in drying soil. The authors also present the case for interaction between soil water and nutrient status on plant growth and function, suggesting a possible low-technology approach to enhancing drought tolerance of crops by manipulating nutrient concentrations in the soil.

Chapter 6, "Water availability and productivity," emphasizes water-limited environments, as illustrated by the Mediterranean climate, and includes sections on native vegetation, agriculture, and forestry. Connections to spatial and temporal variability in precipitation are made throughout. The presentation style tends toward a literature review as opposed to a synthesis of knowledge, but the authors did produce a commendably thorough bibliography covering seminal literature and recent results. The topic is inherently difficult to package neatly because of the coupling between micrometeorological and plant variables, creating a complex system of dynamic feedback loops and responses to degree of water deficit. Relevant to agricultural systems is the concept that irrigation can be applied as a tool to mimic drought or to impose controlled water deficit in some crops without compromising yield. Breeding approaches to increase the ratio of yield : water used may be most applicable to annual crops. The largest gaps in knowledge pertain to forest ecosystems.

Chapter 7, "Effects of temperature and precipitation changes on plant communities," addresses community distribution and composition in natural systems. The text is well-written with a balanced approach in which a succinct discussion of the principle at hand is followed by an example of experimental or observational results from the literature. Because existing literature is invested heavily in temperate, boreal, and polar regions, the discussion is framed within that perspective. Outlined are advantages and disadvantages of five broad categories of methods from long-term monitoring to modeling. The authors note importantly that global change models are most defined for temperature, whereas there is much more uncertainty in precipitation and wind models. Most climate models predict an increase in the frequency of extreme events, and it is postulated that among the most likely drivers of change in plant communities will be exceptional droughts in areas that do not regularly experience such.

Chapter 8, "Issues in modeling plant ecosystem responses to elevated CO_2: interactions with plant nitrogen," identifies major obstacles to developing credible long-term models, using the generic decomposition and yield (G'DAY) ecosystem model to illustrate N cycling scenarios for a pine-dominated forest stand over 100 years. The authors clearly stated their aims and context, but I found this chapter less useful than some because of the focus on the single model and the text reading much like a research article in a journal. Initial sections include cogent description of the need for process-based models to bridge the scales typical of experimental observations (shorter-term, smaller-scale) and those relevant for policy discussion (decadal to century-scale). Detailed are eight sets of G'DAY model predictions for N uptake, net primary productivity, and net ecosystem productivity. The term "model-data fusion" is repeated liberally throughout, defined as a set of quantitative methods to improve model predictions based on observations. Better definition of terms may have been helpful. Read chapter 9 before chapter 8.

Chapter 9, "Predicting the effect of climate change on global plant productivity and the carbon cycle," is a succinct, well-written review of concepts that underlie measurement and modeling. It suggests how constituent fluxes may change under higher CO_2 and nitrogen availability and acknowledges varying levels of uncertainty, within the generally accepted forecast that over the next 100 years atmospheric CO_2, global temperature, and rates of N deposition will increase. The effects of climate change on photosynthesis, for example, are expected to vary by biome,

positively for regions limited by cold winters but less so in the tropics. Briefly surveyed are typical measurement approaches for net and gross primary productivity, and net ecosystem productivity. The key mechanistic model of photosynthesis at the leaf level, the Farquhar model, is reviewed and placed in context with ecosystem modeling. As of 2006, only two climate models had incorporated coupling of carbon cycle models to a fully developed global circulation model, and the two disagreed about the significance of temperature effects.

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An Introduction to Plant Breeding. Jack Brown and Peter Caligari. 2008. Blackwell Publishing, 9600 Garsington Road, Oxford OX4 2DQ, UK. 209 p. $69.00, paperback. ISBN: 978-1-4051-3344-9.

I really wanted to like this book. Well-written books on plant breeding are few and far between – books giving a balanced account of the principles and methods being used by practical plant breeders, working in the trenches of day-to-day cultivar development and release. The detailed index of the book gave hope that it would be comprehensive, well-balanced, and well-organized. The back cover states: "*An Introduction to Plant Breeding* has been carefully compiled by the authors, who have between them many years' experience as plant breeders, and as teachers of undergraduate and postgraduate courses in plant sciences and plant breeding. This important publication provides comprehensive coverage of the whole area of plant breeding. Subjects covered include: modes of reproduction in plants, breeding objectives and schemes, genetics, predictions, selection, alternative techniques, and practical considerations. Each chapter is carefully laid out in a student-friendly way and includes questions for the reader."

You will see later that I question several of these claims, but I will first continue with what I liked about this book.

I like the way the book is printed and laid out on the page. It reminds me of my favorite plant breeding book, N.W. Simmonds' *Principles of Crop Improvement*, Longmans, 1979. There are lots of lists, short tables, flow charts, and other features that break the topics into small blocks of information that help the reader stay focused. I like the two-column layout, the type, the size and shape of the book and the way it feels in my hand. A few parts of the book are clear and interesting, for example, "Outline of a potato breeding scheme" on page 54 and all of chapter 8 (Alternative Techniques in Plant Breeding), which discusses induced mutations, interspecific and intergeneric hybridization, haploidy, plant transformation, and the use of molecular markers in plant breeding.

For me, the potential usefulness of this book was almost entirely undermined by problems that could have rather easily been corrected. The book appears to have had no editor, and it appears that nobody read or corrected the page proofs. The text is strewn with examples of wrong or confusing punctuation, poor word choice, contradictions, and other sources of confusion. I could here cite 50 or 100 examples, but the abused reader will discover them soon enough. With careful writing, all the material in this book could have been presented in a way that would have reduced my reading time by 50% or more and greatly improved my comprehension, not by reducing the length of the text, but by organizing the material and by making each sentence clear. Often, while studying the book, I wondered whether I was losing my ability to read and understand text (on page 64, column 1, bottom chart: where did the C alleles come from?; in the chart on page 124, column 2, is the second "year 1" supposed to be "year 2"?, etc.).

It is clear that the authors have had much experience in plant breeding, and this experience is the basis of much of what is valuable in this book. Nonetheless, they make a few surprising assertions. On page 8 we read: "Yield increases of more than 100% have been found between single cross maize cultivars over the traditional homozygous cultivars." Traditional maize cultivars have never been homozygous – they were open-pollinated heterozygous populations. There are other statements and ideas with which readers will disagree, but in general, most of the information in the book is sound and useful, if a reader has the patience to sort through the words and sentences to find the ideas.

On first reading the title of the book: *An Introduction to Plant Breeding*, I feared that it might be a superficial, watered-down retelling of basic information. This was definitely not the case. However, I would never recommend the book to a beginning student. It is hard to read, uses advanced technical terms long before it defines them, and conveys little of the excitement that might make a student want to enter the profession. The beauty, power, and simplicity of plant breeding do not come through in this book. As a seasoned plant breeder, I found useful and interesting information in every chapter but was totally frustrated by the writing. I wish a new and carefully edited edition of this book could immediately be made available, or at least that a list of corrections could be prepared and sent electronically to everyone who buys this book.

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