Plant Growth and Climate Change

As we are reminded in Chapter 5 of this book “… even subtle changes in the environment are likely to have significant effects on composition and functioning of natural plant communities and on the productivity of agriculture in even the most productive areas of the world.” As the current state of our environment finds us with atmospheric CO$_2$ at a concentration higher than any time in most likely the last 20 million years and as the 1990s were the warmest decade for the last 1000 years we can only conclude that climate change is, and will continue to be, a powerful influence on our agricultural and natural ecosystems. Evidence that these changes are already in train is given by the chapter here by Menzel and Sparks that demonstrates biologically meaningful changes are occurring that can be ascribed to increasing temperatures.

Most of this book is a summary of plant responses to elevated CO$_2$, to temperature, and to water supply. These are thorough reviews of value to undergraduate and graduate students and a useful reference source for researchers in the field. Some interesting observations are made; for example, the notion of CO$_2$ concentration being temporally and spatially variable (Ziska and Bunce) forces us to review our definition of ambient CO$_2$ and Christian Körner reveals several paradoxes that highlight the difficulty of extrapolating from plant physiological information to ecosystem function and performance. I particularly enjoyed the chapter by William Davis that considers responses to water as it contains not just potential impacts but also a strategy for adaptation. I would have liked some further discussion and analysis of interactions among the main climate change drivers.

The final chapters are interesting in demonstrating both the importance of understanding climate change and the difficulty of achieving this. Grace and Zhang consider the estimation of the terrestrial sink for carbon, a sum that is an essential input to the prediction of future atmospheric CO$_2$ concentrations. Some modeling predicts a growing sink capable of absorbing future emissions; however, several uncertainties are attached to these predictions. One of these is highlighted in the chapter by Wang et al. that considers how the availability of nitrogen might change in the future exerting a negative feedback on plant response to climate change. Wang et al. go on to describe the difficulties in this area of study and the desirability of transferring more experimental data into models and a way in which this might be achieved.

This book is a reliable summary of where we stand in our understanding of climate change impacts on our terrestrial ecosystems. Surely we have improved our knowledge of the relevant plant physiology, but some critical issues—such as nitrogen availability—remain uncertain as does the outcome of interactions among multiple drivers. There is a strong message in this book that further experimentation is essential, particularly the use of multifactor experiments, and a call for a greater range of experimental approaches. These views will be widely supported by those working in this field.

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