Plant Growth and Climate Change.

Edited by J. I. L. Morison and M. D. Morecroft.

A host of uncertainties have been imposed on agricultural systems and natural ecosystems by the current episode of anthropogenic climate change. The vast increase in greenhouse gases, particularly CO$_2$, is predicted to cause global shifts in temperature and patterns of rainfall. The early research focus on how plants will respond to enhanced CO$_2$ or increased temperature is no longer sufficient for plant scientists who need to be able to make predictions under a span of climate change scenarios. *Plant Growth and Climate Change* provides current tools and techniques required to respond to the predicted changes in temperature, rainfall, and nutrient cycling wrought by the current increase in greenhouse gases.

This edited volume draws on multiple disciplines, using a wide variety of techniques to study plant responses to anthropogenic climate change. The book is a unique synthesis, in that it combines studies in managed systems (agriculture and forestry) with studies on natural ecosystems, while also covering a wide range of scales, from molecular to global. The text covers major themes in plant responses to climate change, introducing a variety of techniques throughout, such as physiology in controlled environments, long-term data sets from observational studies, manipulative field experiments, and mathematical modeling. A major theme that emerges from the book is the complexity inherent in the response of plants to changing water, temperature, and CO$_2$ regimes. Many more questions are raised than answered, thus highlighting the vast avenues of research in this emerging field. Plant scientists from a wide range of disciplines, from crop science to plant ecology, can explore the myriad issues and techniques for the study of plant responses to enhanced CO$_2$, and changes in temperature, precipitation, and nutrient regimes. This book should appeal to researchers and advanced graduate students in a variety of disciplines, including crop science, plant physiology, plant ecology, and earth systems science.

The scope of the book is enormous, matching the scope of the problem of anthropogenic climate change. The list of authors is impressive, with wide international representation of researchers from a vast number of fields. The first chapter serves as a summary of the implications of climate change for plant growth, relying heavily on the findings of the 2001 Intergovernmental Panel on Climate Change (IPCC) through the use of Global Climate Models (GCM). The authors do an excellent job of relaying the uncertainties and limitations of the GCM models, while also summarizing major model predictions. The response of plants to changes in CO$_2$ is addressed in Chapters 2 (via gene expression through physiology) and Chapters 8 and 9 (via mathematical modeling). The role of temperature in plant physiology and phenology is addressed in Chapters 3 and 4, respectively. Responses of plants to water availability are addressed in three chapters, both at the physiological level (Chapter 5) and the ecological level (Chapter 6 and 7). Several of the chapters focus almost entirely on agricultural systems but at least a few chapters explore impacts of climate change on natural communities. The lessons from chapters focused on crops can be easily applied to natural systems, so the book is appropriate for scientists from diverse fields.

This book will be most valuable to professionals, researchers, and graduate students with a firm background in plant science, especially in fields with crossover between physiology and ecology. In addition to its wide coverage of different disciplines and different scales, the book had several strengths. Each chapter in the book was well organized and contained a number of helpful graphs, tables, and diagrams. The six color plates enhanced the material in several of the chapters, especially for understanding model outputs. The chapters on modeling were accessible to the non-mathematician, and highlighted both the roles and limitations of models in making predictions on plant responses to climate change. Each chapter serves as an excellent review of the current literature, and extensive reference lists provide avenues for further exploration of the topics.

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