## Contents

### Chapter 1  Contexts, Perspectives, and Principles

- Plant interactions with the atmosphere, hydrosphere, and geosphere underpin terrestrial ecosystems  
- Minimizing human impact on ecosystems and achieving global food security are significant challenges  
- Proximate and ultimate questions elucidate how and why plants interact with the environment  
- Resources, stressors, and toxins affect plant biomass production and quality  
- Environmental factors that affect plant growth are interacting but independent variables  
- Many reference soil groups are a product of interacting environmental variables  
- Spatial and temporal analyses provide insights into plant responses to environmental variation  
- Plants process information about environmental variation using signaling networks  
- Differences in gene expression and in the genes expressed underpin a hierarchy of plant adaptations  
- Environmental plant physiology is ecologically useful in defining plant traits and niches  
- Studying plant–environment interactions can help to increase agricultural efficiency and sustainability  
- Modeling is improving our understanding of plant–environment interactions  
- Summary  
- Further reading  

### Chapter 2  Light

- In plants, ancient photosynthetic systems provide the chemical energy for terrestrial ecosystems  
- Photosystems, cytochromes, and ATP synthases transduce light energy into chemical energy  
- Terrestrial plants have to adapt to a generally high and very variable light regime  
- Plants can adjust quickly to variation in PAR using non-photochemical quenching  
- Plants can adjust electron flows to help them to withstand variable light intensities  
- PSII repair is important in plants that tolerate high light intensities  
- Chloroplast movements can be used to adjust fairly rapidly the amount of light absorbed  
- Photosystems, grana, and thylakoids adapt to differences in light regime  
- Leaf optical properties are adapted to long-term variation in light regimes  
- Adjustments in leaf position and plant architecture adapt plants to different light regimes  
- Photoinhibition is most severe in alpine environments  
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### Chapter 3  Carbon Dioxide

- CO₂ fixation underpins the primary production of biomass  
- Variation in the supply of CO₂ to plants is significant and affected by human activity  
- The regulation of rubisco activity controls CO₂ entry into the Calvin–Benson cycle  
- Oxygenation of RuBP decreases growth but provides rapid metabolic flexibility  
- When there is a sustained low CO₂ supply, C₄ plants maintain a high CO₂:O₂ ratio in the vicinity of rubisco  
- C₃-C₄ intermediates and C₄ plants show distinct responses to chronic differences in the environment  
- Crassulacean acid metabolism adapts plants to chronically difficult CO₂-fixation conditions  
- Long-term increased CO₂ levels can increase plant growth, but limiting factors can moderate this effect  
- Plant responses to increasing CO₂ levels will affect the hydrological cycle and Earth’s climate  
- An understanding of CO₂ fixation by plants is important for sustainable food production and ecosystem conservation  
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