Part II
Mechanisms of Resource Allocation in Plants and Stands

Introduction

Part II addresses, in view of the introductory considerations of Part I (Chap. 1), the several spatiotemporal dimensions of mechanisms in resource allocation of plants and stands. Chapter 2 starts up elucidating the molecular regulation of plant resource allocation and explores means for identifying mechanistic links with the biochemical/physiological process level. On such grounds, biotic interactions and their interrelationships are demonstrated as determining allocation control and performance. Chapters 3, 4, and 5 accordingly address plant–pathogen, plant–herbivore, and plant–mycorrhizosphere relationships, respectively. Cost/benefit relations will be introduced in Chap. 6 regarding respiration and carbon-use efficiency as allocation determinants at the whole-plant level. With carbon as a resource that affects allocation at various spatiotemporal scales from cells to ecosystems, Chap. 7 will review state-of-the-art tracing methodologies as a prerequisite for integrating cost/benefit considerations within plants and stands.

Reaching this stage, Part II will focus on the stand-level partitioning of resources driven by competition, exemplifying this crucial variant of biotic interaction for woody-plant systems. Quality and quantity of light as the energy resource, being both consequence and determinant of competition, will be addressed by Chap. 8, given the canopy architecture of a managed beech/spruce forest. The respective structural settings provide the stage for the three-dimensional plant and stand-level partitioning of nutritional elements, as demonstrated by Chap. 9, and Chap. 10 will resume cost/benefit considerations in view of nutrient acquisition and associated efficiencies in belowground space exploration and exploitation through symbiotic soil microorganisms and their interrelationships. A whole-plant perspective will be pursued in Chap. 11 with the about 60 years old and up to 30 m high forest trees, demonstrating the intrinsic link of carbon and water turnover with above and belowground efficiencies of space-related resource use as determinants of individual competitiveness under stand conditions. Responsiveness is examined under natural and experimental abiotic and biotic stress, bridging to Chap. 12 which submits the introduced efficiencies to an analysis of the mechanistic grounds of individual competitiveness. A basis is provided for examining, in Chap. 13, the allometric plasticity of plants in determining structural patterns and associated

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resource turnover at the stand level. Eventually, the extent will be investigated to which stand development mirrors links to resource allocation within and between neighboring plants (Chap. 14). This assessment at the uppermost spatiotemporal level of biological organization reached in this book will complete the overview on interrelated mechanisms that underlie resource allocation in plants and stands.