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Introduction

Life on earth is carbon based and is sustained by photosynthetic use of energy from sunlight to ?x atmospheric CO_2. With evolution of life, primitive photoautotrophs gave rise to vascular plants which in turn adapted to changing aquatic and terrestrial environments via distinctive modes of photosynthesis.

Features of C_3, C_4 CAM and SAM photosynthesis (Section 2.1) highlight the central signi?cance of Rubisco and outline metabolic extensions to that basic process that have enabled adaptation to arid regions (CAM) and aquatic environments (SAM), or have led to spectacular gains in photosynthetic capacity of C_4 plants (C_4 subgroups in Section 2.2).

Paradoxically, oxygenic photosynthesis in C_3 plants is actually inhibited by oxygen! This outcome has major implications for global productivity and holds special relevance for comparative performance of C_3 and C_4 plants. Recognition of such O_2-dependent photorespiratory loss of carbon from C_3 plants but not from C_4 plants represented a major paradigm shift in plant science and is recounted in Section 2.3.

Finally, a signi?cant fraction of the carbon gained via photosynthesis becomes a respiratory substrate for generation of energy to sustain vital processes, as well as providing carbon skeletons for a multitude of synthetic events (Section 2.4).

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