

Preface

Since writing the first edition of this book twelve years ago, the motivation for writing a second edition of *The Evolution of Plants* is even stronger than before. The global challenges facing the planet in terms of climate change and pressures upon landscapes for food, fuel, and human population growth have increased further; so too has the political and scientific will to find pragmatic solutions to these challenges. An understanding of the evolutionary and ecological processes responsible for driving one of the most important parts of Earth's ecosystem, the plants, is paramount to this. What is also apparent is that understanding these processes requires studies spanning a very long timescale. Evolutionary change occurs over millions of years and even 'shorter-term' ecological processes may take hundreds of years to become apparent (given that the average generation times of most trees is between 50–100 years). From changes occurring in genes, through to species, communities, and biomes, a knowledge of processes occurring in deep time is essential; it is only by addressing these timescales that a proper appreciation of natural variability of ecosystems, their resilience to environmental change, and their propensity to alter can occur.

A huge volume of literature and excellent studies on plant evolution go before this book, and this volume is first and foremost dedicated to the scholars of this work. This book represents a synthesis of these studies put into an environmental framework. We review the evidence for major intervals of plant evolution in Earth's history and discuss them against the geological evidence for the global environmental change occurring at the same time. These include, for example, episodes of major plate movements, intervals of ice-house and green-house Earth, changing atmospheric concentrations, and altered incoming solar energy. Understanding how ecosystems in the past responded to warmer global temperatures and much higher levels of atmospheric CO₂ is particularly poignant—but so too is an understanding of plant responses to intervals of higher UV-flux, atmospheric O₂, and episodes of increased variability in the climate. Over the past twelve years, the knowledge base in some areas of this research has greatly increased, particularly in the use of molecular phylogenies to understand evolutionary relationships. Important new fossil discoveries, the application of cutting edge methodology, and the development of new proxies, together with more concise dating of sequences, have also resulted in a more in-depth understanding of plant evolution as revealed from the fossil record. The dating of major transitions in plant evolution, determined predominantly through the fossil records, have withstood the test of time, although there are now many more detailed taxonomic and environmental datasets available to provide a more detailed overview of these critical intervals in time.

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