PLANT MICROEVOLUTION AND CONSERVATION IN HUMAN-INFLUENCED ECOSYSTEMS

As human activities increasingly domesticate the Earth's ecosystems, new selection pressures are acting to produce winners and losers amongst our wildlife. With particular emphasis on plants, Briggs examines the implications of human influences on microevolutionary processes in different groups of organisms, including wild, weedy, invasive, feral and endangered species. Using case studies from around the world, he argues that Darwinian evolution is ongoing. He considers how far it is possible to conserve endangered species and threatened ecosystems through management, and questions the extent to which damaged landscapes and their plant and animal communities can be precisely recreated or restored. Many of Darwin's ideas are highlighted, including his insights into natural selection, speciation, the vulnerability of rare organisms, the impact of invasive species, and the effects of climate change on organisms. This is a thought-provoking text for students and researchers of evolution, conservation, climate change and sustainable use of resources.

Particular highlights include:

- An assessment of how neo-Darwinian concepts impact on the theory and practice of conservation in the context of climate change, alerting the reader to the implications of this novel approach
- Background information on basic elements of genetics, molecular methods, climate change, ecology and population biology, with particular reference to plants, which serves as a useful guide for students
- Case studies from many different countries, which make the book globally relevant

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Preface

It is often erroneously believed that evolution is something that happened in the past. However, there is strong evidence that evolution is continuing at the present time, as plants face new selection pressures generated by human activities that destroy, damage, fragment and alter ecosystems. In a world grappling with anthropogenic climate change, such pressures are likely to increase, as human populations, presently about 6.5 billion, are projected to rise to 12.8 billion by 2050 (if fertility remains at present levels).

In human-influenced landscapes, two broad classes of plants are often recognised, based on their apparent success or relative failure. Thus, some species are 'winners' (crop plants, weeds, invasive plants etc.). Others, the endangered species, are 'losers' or 'potential losers', with extinction their likely fate. Put simply, some plant species appear to be at a selective advantage in changing ecosystems and their populations are stable or increasing, while others faced with the same selection pressures are declining and threatened with extinction. Traditionally, but with some honourable exceptions, these two facets of evolutionary change are treated as separate subjects in academic books and elsewhere. Here, the notion of winners and losers is considered as a single concept, as major insights emerge through such an approach.

Another main focus of the book is the examination of conservation efforts in the light of our understanding of evolution. Many conservationists believe that the major challenge is to persuade the general public and political leaders that conservation of biodiversity is important and resources should (indeed must) be found to secure the future of endangered species and ecosystems. However, given that a great deal of support has often been secured, the key question to confront, in the current struggle to devise successful conservation strategies and effective management, is whether such activities are likely to succeed. In essence, conservationists are attempting to ensure the long-term survival of threatened species and ecosystems by preventing or modifying the impact of deleterious selection pressures brought about by human influences. They have the belief that by re-imposing the appropriate edaphic and biotic environments long-term self-sustaining populations of endangered species may be perpetuated. How far are conservation objectives likely to succeed in the long term? If these endeavours fail, and many species become extinct, what are the likely consequences for biodiversity and human development? How will the losses or potential losses influence the future of plant evolution? It is timely to examine the

theoretical and practical basis of plant conservation in a Darwinian context, especially in 2009, as this year marks the 200th anniversary of Darwin's birth and the 150th anniversary of the publication of *On the Origin of Species*.

There are a number of excellent accounts of plant evolution, conservation, environmental issues and climate change, and reference will be made to many in the text. It is not my intention to provide comprehensive coverage of these major areas of concern, but to consider, with appropriate examples, the 'interface' between microevolution and conservation in plants growing in ecosystems subject to human influence and management. Ideally, all the many life forms of biodiversity should be considered, but this is not possible within the confines of this book. The focus is on wild, introduced, invasive, feral and weedy plants, together with crop–weed and crop–wild relative interactions. The fate of rare and endangered plants will also figure large in the account.

The text deals primarily with plants. But, given that much of conservation theory and practice comes from zoological investigations, and acknowledging the manifold interactions in ecosystems, some important ideas and selected research findings from studies of animals will be briefly considered. Such studies continue to provide important models for botanical researches.

The intention in writing this book is to provide an authoritative, up-to-date text for undergraduate and postgraduate students studying evolution, conservation and aspects of climate change, while at the same time exploring the implications of recent advances to conservation practitioners. The book is also designed to appeal to the general reader with a real interest in the subject. With this diversity of readership in mind, some important background areas of genetics, landscape ecology and population biology are explored. As the text examines interconnections between complex subjects, references to important papers are provided in order that the reader can build on the framework provided.

This book is written in the same spirit as the three editions of D. Briggs and S. M. Walters, *Plant Variation and Evolution* (1969, 1984 and 1997). I have set out to provide a critical but concise account of the logical and historical development of the subject, as well as a review of current excitements and advances, while at the same time paying attention to difficulties and uncertainties. Throughout the book the aim is to engender a critical attitude of mind, reflecting my own outlook in being uncommitted and even sceptical about neat explanations and simple formulations.

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Abbreviations

AFLP	Amplified Fragment Length Polymorphism
BDFFP	Biological Dynamics of Forest Fragmentation Project
BGCI	Botanic Gardens Conservation International
BP	Before the present
CITES	Convention on International Trade in Endangered Species
cpDNA	Chloroplast DNA
EU	European Union
FAO	Food & Agriculture Organization of the United Nations
IPCC	Intergovernmental Panel on Climate Change
ISSR	Inter Simple Sequence Repeat markers
IUCN	International Union for Conservation of Nature
MVP	Minimum Viable Population
ppb	Parts per billion
PPGRI	International Plant Genetic Resources Institute
ppm	Parts per million
PVA	Population Viability Analysis
RAPD	Randomly Amplified Polymorphic DNA
RFLP	Restriction Fragment Length Polymorphism
RSPB	Royal Society for the Protection of Birds
SSSI	Site of Special Scientific Interest
STR	Short Tandem Repeat
UN-ECE	United Nations-Economic Commission for Europe
UNEP	United Nations Environmental Programme
WCMC	World Conservation Monitoring Centre