

ESSENTIALS OF
**CONSERVATION
BIOLOGY**

FIFTH EDITION

Richard B. Primack



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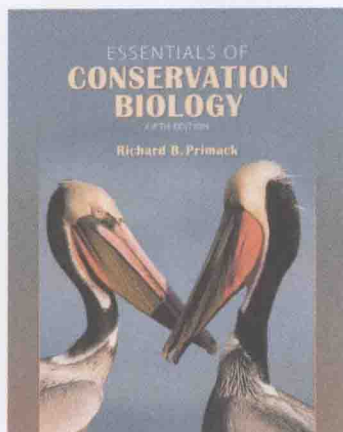
FIFTH EDITION

Richard B. Primack

Boston University



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About the Cover

Brown pelicans (*Pelecanus occidentalis*) represent a conservation success story. Pelican numbers had declined in the United States, with the pesticide DDT identified as the cause of thinning eggshells and a lack of reproduction. Since its listing under the U.S. Endangered Species Act in 1970 and the banning of DDT, brown pelican numbers have increased substantially. Because of this recovery, the brown pelican was removed from listing under the Act in 2009. (Photograph © Tom Vezo/Minden Pictures.)

Essentials of Conservation Biology, Fifth Edition

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*To my family, Margaret, Dan, Will, and Jasper,
and the teachers who inspired me,
Carroll E. Wood Jr. (1921–2009) and Janis Antonovics*

Preface

After decades of public interest in nature and the environment, the United Nations focused worldwide attention on conservation by declaring 2010 to be the International Year of Biodiversity. The general public has absorbed this message and is asking its political leaders to provide the policy changes needed to address this issue. Conservation biology is the field that seeks to study and protect the living world and its biological diversity (or biodiversity in its shortened form). The field emerged during the last 35 years as a major new discipline to address the alarming loss of biological diversity. The threats to biodiversity are all too real, as demonstrated by the recent recognition that fully one-third of amphibian species are in danger of extinction. At the same time, our need to remain hopeful is highlighted, for example, by increasing sea turtle populations at many locations throughout the world following comprehensive conservation efforts. Many examples described in this book show that governments, individuals, and conservation organizations can work together to make the world a better place for nature.

Evidence of the explosive increase of interest in conservation biology is shown by the rapidly increasing membership in the Society for Conservation Biology, the great intellectual excitement displayed in many journals and newsletters, and the large numbers of new edited books and advanced texts that appear almost weekly. International conservation organizations have emerged to tackle conservation issues with a multi-disciplinary approach, and an *Encyclopedia of Life* is being developed as an online resource to provide the needed information for conservation issues.

University students continue to enroll enthusiastically and in large numbers in conservation biology courses. Previous editions of *Essentials of Conservation Biology* have provided a comprehensive textbook for this subject. (The *Primer of Conservation Biology*, in its Fourth Edition, continues to fill the need for a “quick” guide for those who want a basic familiarity with conservation biology.) The Fifth Edition of *Essentials* provides a thorough introduction to the major concepts and problems of the field. Like its predecessors, it is designed for use in conservation biology courses, and also as a supplemental text for general biology, ecology, wildlife biology, and environmental policy courses. The book is also intended to serve as a detailed guide for professionals who require a comprehensive background in the subject. Readers should enjoy and benefit from the updated full-color illustration and photo program. Highlighted synopses of major points in the text have been added as sidebars and serve as useful study aids.

This Fifth Edition reflects the excitement and new developments in the field. It provides coverage of the latest information available on a number of topics, including the expanding system of marine protected areas and linkages between conservation and global change. It also highlights new approaches culled from the literature on topics such as species reintroductions, population viability analysis, protected areas management, and payments for ecosystem services. Also new to this edition is an Instructor’s Resource CD, available to qualified adopting instructors of the text. This IRCD includes electronic versions of all the figures, photos, and tables from the textbook.

In keeping with the international approach of conservation biology, I feel it is important to make the field accessible to as wide an audience as possible. With the assistance of Marie Scavotto and the staff of Sinauer Associates, I have arranged an active translation program, beginning in 1995 with translations into German and Chinese in 1997. It became clear to me that the best way to make the material accessible was to create regional or country-specific translations, identifying local scientists to become coauthors and to add case studies, examples, and illustrations from their own countries and regions that would be more relevant to the intended audience. To that end, in the past 12 years, editions of *Essentials* have appeared in Arabic, Hungarian, Romanian, and Spanish with a Latin American focus; and the *Primer* has appeared in Brazilian Portuguese, Chinese (two editions), Czech, Estonian, French with a Madagascar focus, Greek, Indonesian (two editions), Italian, Japanese (two editions), Korean (two editions), Mongolian, Romanian, Russian, Spanish, and Vietnamese. New editions of the *Primer* for France, South Asia, Pakistan, Turkey, and the Czech Republic are currently in production. It is my hope that these translations will help conservation biology develop as a discipline with a global scope. At the same time, examples from these translations find their way back into the English language editions, thereby enriching the presentation.

I hope that readers of this book will want to find out more about the extinction crisis facing species and ecosystems and how they can take action to halt it. I encourage readers to take the field's activist spirit to heart—use the Appendix to find organizations and sources of information on how to help. If readers gain a greater appreciation for the goals, methods, and importance of conservation biology, and if they are moved to make a difference in their everyday lives, this textbook will have served its purpose.

Acknowledgments

I sincerely appreciate the contribution of everyone who helped make this book accurate and clear. Individual chapters in this edition were reviewed by Dana Bauer, Patrick Bohlen, Katrina Brandon, Sue Bratton, Phil Cafaro, Linus Chen, Richard Corlett, Chris Elphick, Richard Frankham, Elizabeth Freeman, Richard Griffiths, Susan Jacobson, Christopher Johnson, Jeff McNeely, Michael Reed, Tom Ricciardi, Marcos Robles, Eric Seabloom, Jodi Sedlock, Howard Snell, and Navjot Sodhi. Les Kaufman of Boston University provided expertise on marine systems in all chapters.

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Special thanks are due to my wife Margaret and my children Dan, Will, and Jasper for encouraging me to fulfill an important personal goal by completing this book. I would like to recognize Boston University for providing me with the facilities and

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Richard Primack
Boston, Massachusetts
April, 2010

Media and Supplements to accompany *Essentials of Conservation Biology*, Fifth Edition

Instructor's Resource Library (ISBN 978-0-87893-638-0)
(Available to qualified adopting instructors.)

The *Essentials of Conservation Biology* Instructor's Resource Library includes all of the textbook's figures (including photos) and tables, in several formats. Each figure has been formatted and optimized for excellent legibility when projected in the classroom. Images are provided as both low-resolution and high-resolution JPEGs, and a PowerPoint® presentation of all figures and tables is provided for each chapter, making it easy to quickly incorporate figures into lecture presentations.

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Conservation Biology: A Dynamic and Growing Field

Popular interest in protecting the world's biological diversity—including its amazing range of species, its complex ecosystems, and the genetic variation within species—has intensified during the last few decades. It has become increasingly evident to both scientists and the general public that we are living in a period of unprecedented biodiversity* loss. Around the globe, biological communities that took millions of years to develop, including tropical rain forests, coral reefs, temperate old-growth forests, and prairies, are being devastated by human actions. Thousands, if not tens of thousands, of species and millions of unique populations are predicted to go extinct in the coming decades (MEA 2005). Unlike mass extinctions in the geological past, in which tens of thousands of species died out following massive catastrophes such as asteroid collisions with the Earth and dramatic temperature changes, today's extinctions have a human face. Never before in the history of life have so many species and ecosystems been threatened with extinction in so short a period of time. Never before has such devastation been caused by beings who claim reason, a moral sense, and free will as their unique and defining characteristics. The overwhelming cause of all this loss is the rapidly expanding human population.

*Biological diversity is often shortened to biodiversity.