

PREFACE

As a professor of ecology, I study nature and teach about what I have learned. Most of my teaching occurs in a university setting. But I also spend time teaching to enhance public awareness by speaking to various clubs and organizations. I find it highly rewarding. As a professor, I am also extremely fortunate because my vocation is my avocation. I am able to spend hours upon hours engaged in research, driven by my lifelong curiosity and wonder to discover the fascinating ways that nature works, and how humans with their various needs, wants, and values engage with it. I feel that as professors we have a tremendously important responsibility to teach current and future generations about these new findings; to excite them about ecology; to inspire them to take the torch and enrich the means and know-how that helps society achieve sustainable livelihoods. Most of us do this out of a personal ethic, a sense of obligation to uphold an implicit yet important social contract to provide society returns on its investment. As scientists, we strive to repay society's trust by doing our utmost to advance the kind of knowledge and practice that ultimately helps to solve environmental problems for the betterment of nature as well as for humankind.

In the course of doing all this, I continually find that ecology has come to mean different things to different people across society; and their views of how ecology can help society differ widely as well. This book is my way, as a professional ecologist, to explain to a broad readership what modern ecology is about, how it speaks to the many different viewpoints about science and nature that are held in society, and the new advances that ecological science is making in support of the health and welfare of all life on this planet.

Modern ecology—the New Ecology that I describe in this book—is the result of ecologists' expanding the frontiers of the life sciences with meaningful implications for society. Ecologists can now offer ways to reconcile, and perhaps even harmonize, different ethical views that humans hold toward nature, together with a scientific one rooted in ecological and evolutionary biology. Ecologists have come to embrace a new world view that nature should be viewed as the emergence of a perpetual ecological-evolutionary process of creation. This process provides the resilience needed to maintain sustainability in an ever-changing world. The deepest revelation of this comes from research focused on that creative process as opposed to merely marveling at and describing the magnificence of its products (e.g., the diversity of extant species). This new world view has implications for the ethical standing that we should extend to nonhuman life, especially as regards human management and conservation of the Earth's biota.

The goal of the book, first and foremost, is to show that ecology is a science devoted to studying the mysteries of the natural world. Ecological science endeavors to explain why different species exist in different geographic locations across the globe, why some are highly abundant and others not, and how environmental conditions and the nature of their interactions with each other control the functioning of ecosystems.

To do this, ecological science probes into the intricacies of how the genetic make-up and physiology of individual organisms determines their ability to cope with changes in the chemical, physical and climatic conditions of their environment. It relates how those intricacies shape the behavioral trials and tribulations of organisms as they vie for their share of limiting resources, or avoid becoming resources for other organisms, as they strive to make their way and grow and reproduce. It reveals how organisms fit together in communities through consumptive, competitive and cooperative relationships with other organisms. It traces how those interdependent relationships influence the flow of materials and energy, the production of food, the recycling of nutrients—all of which determine how ecosystems function. It tracks the ebb and flow of organisms and materials and energy across broad landscapes. It is a science that stirs awe as it demystifies nature's complexity.

As recently as fifty years ago, one could safely devote a career undertaking this kind of ecological study in

vast tracts of wilderness largely devoid of humans or their impacts. It led to an ecological world view that humans and nature, for all intents and purposes, existed apart: as a human/nature divide, if you will. But the human population and its global reach now looms so large that it is no longer tenable to think of nature being unfettered by human influence. While wilderness does still exist, it is fragmentary owing to rising human domination of the Earth's space. The attendant rise in consumption of natural resources accompanied by and even driven by rapid technological development has done much to change the Earth. There is now cause for concern that the capacities of the Earth's ecosystems to sustain their functioning is becoming increasingly strained.

The New Ecology that I describe in this book is one that also aims to overcome the human/nature divide and tackle the issue of sustaining ecological functioning in the face of a growing human domination of the Earth, in a new epoch that has accordingly been called the Anthropocene. Ecological science is assuming a leading role to help guide the growing human enterprise, to support the needs and wants of a burgeoning human population, without jeopardizing nature's ecological functions that support humanity's needs and wants. It is doing this by advancing new concepts and theories to better explain the workings of an ever-changing world. This is what any science must do to remain vibrant and relevant. It means re-imagining how

humans and nature come together to form functional systems, called socio-ecological systems. It means becoming more interdisciplinary in scope, to find creative ways to integrate the study of humanity (economics, anthropology, political and social science, religion and ethics) with the study of nature. It means ensuring that socio-ecological systems are sustainable. This essentially boils down to ensuring that they have the enduring capacity to be productive in the face of exploitation by making sure that species can exist and perform their functions over the long run.

This book sketches a portrait of a scientific field that is developing new ideas and ways to help humankind thoughtfully engage with nature in the interest of promoting a sustainable world. It addresses how human values and choices influence what ecosystems look like and how they function. It reveals how species, collectively through their functions, provide numerous services that humans have come to rely on to sustain their health and livelihoods. It engages in the ethical conundrums humans face when weighing the costs and benefits of various ways to exploit nature in support of their livelihoods. It reveals how choices to exploit nature in one part of the world can reverberate to the other side of the world. It also discusses how humans can use scientific principles to build new "natures" of their own making to transition to sustainable urban and industrial systems. It ultimately aims to show how humans, as part of socio-ecological systems, can use scientific principles

to become thoughtful stewards in the interest of promoting sustainable livelihoods.

My hope is that the reader will come away with a fundamental understanding and fascination about the mysteries of the natural world. But more than this, I hope to offer inspiration and appreciation to think more deeply about how each of us engages with the natural world in our day-to-day lives, and consider the bigger picture implications of our values and choices.

While some historical context will be necessary to set the stage for certain ideas, this book will be largely forward looking to convey how ecology is growing as a science that can anticipate and help solve global environmental problems. The New Ecology offers the scientific means and know-how for humans to become better stewards of our environment, for the sake of humankind, as well as for the sake of the millions upon millions of species with which we share the planet.

This book would not have come together as it has without the help of friends and colleagues. Foremost, I wish to thank my editor Alison Kalett for her encouragement and guidance, to help me find my "non-professor" voice. I wish to thank Shahid Nacem, Reid Lifset, Mary Evelyn Tucker, Adam Rosenblatt, Lauren Smith, Rob Buchkowski, Julia Marton-Lefvre, Anne Trainor, and especially my wife Leslea Schmitz for offering discussion and feedback on various chapters, to ensure that they are technically accurate and that they are conveyed in a way that can be appreciated by a nonspecialist reader.

Finally, I thank my family and friends who have a genuine interest in sustaining nature's economy but are at a loss to demystify its complexity or to know what they can do as part of their lives to leave the world a more sustainable place. They have persisted in encouraging me to write a book that explains what I do in my profession and how it can help them become more thoughtful about their engagement with their natural world.