
Principles of Terrestrial Ecosystem Ecology

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Principles of Terrestrial Ecosystem Ecology

Second Edition

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Cover illustrations: Temperate forest in the eastern U.S. (North Carolina), showing a complex multi-layered canopy with sunflecks common in all canopy layers. Cover Photograph courtesy of Norm Christensen

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Preface

Human activities are affecting the global environment in many ways, with numerous direct and indirect effects on ecosystems. The climate and atmospheric composition of Earth are changing rapidly. Humans have directly modified half of the ice-free terrestrial surface and use 40% of terrestrial production. Our actions are causing the sixth major extinction event in the history of life on Earth and radically modify the interactions among forests, fields, streams, and oceans. This book is written to provide a conceptual basis for understanding terrestrial ecosystem processes and their sensitivity to environmental and biotic changes. We believe that an understanding of ecosystem dynamics must underlie our analysis of both the consequences and the mitigation of human-induced changes.

This book is intended to introduce the science of terrestrial ecosystem ecology to advanced undergraduate students, beginning graduate students, and practicing scientists from a wide array of disciplines. We define terrestrial ecosystem ecology to include freshwater ecosystems and their terrestrial matrix. We also include a description of marine ecosystems to provide a broader context for understanding terrestrial ecosystems and as a basis for Earth-System analysis. We provide access to some of the rapidly expanding literature in the many disciplines that contribute to ecosystem understanding. This second edition incorporates new material that accounts for both the substantial scientific advances in ecosystem ecology during the past decade, as well as the evolution of our own understanding.

The first section of this book provides the context for understanding ecosystem ecology. We introduce the science of ecosystem ecology and place it in the context of other components of the Earth System – the atmosphere, ocean, climate and geological systems. We show how these components affect ecosystem processes and contribute to the global variation in terrestrial ecosystem structure and processes. In the second section of the book we consider the mechanisms by which terrestrial ecosystems function and focus on the flow of water and energy and the cycling of carbon and nutrients. We then consider the important role of organisms in ecosystem processes through trophic interactions (feeding relationships), environmental effects, and disturbance. The third section of the book addresses temporal and spatial patterns in ecosystem processes. We finish by considering the integrated effects of these processes at the global scale and their consequences for sustainable use by human societies. Powerpoint lecture notes that include the illustrations in

this book are available on the web (<http://terrychapin.org/>) as supplementary material.

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