CAMBRIDGE

Cambridge University Press
978-0-521-55986-7 - North American Terrestrial Vegetation, Second Edition
Edited by Michael G. Barbour and William Dwight Billings
Frontmatter
More information

North American Terrestrial Vegetation

North American Terrestrial Vegetation, Second Edition, is a major contribution to botanical and ecological literature and provides comprehensive coverage of the major vegetation types of North America from the arctic tundra of Alaska to the tropical forests of Central America. Each chapter gives the reader a feeling for the composition, architecture, environment, and conservation status of each ecosystem. In addition to vegetation descriptions, information is also included on the abiotic environment, paleoecology, productivity, nutrient cycling, autecological behavior of dominant species, environmental issues, management problems, the role of natural disturbance, and critical areas for future research.

This is an outstanding new edition of a well-received text, and it is essential reading for students and researchers in plant science, ecology, and conservation.

FEATURES OF THE SECOND EDITION

- There are new chapters on freshwater wetlands, coastal marine wetlands, temperate Mexico, the Caribbean Islands, and the Hawaiian Islands.
- The book has been updated throughout with new text and figures and with new literature reviewed.
- Every chapter includes information on habitat loss and restoration-preservation programs that are now mitigating these losses.
- Richly illustrated with many new diagrams, photographs, and tables.
- Includes a complete, cross-referenced topics, species, and place names and regions index

FROM THE REVIEWS OF THE FIRST EDITION

"Far more than a mere compilation of vegetation types, this book synthesizes our current history of the understanding of the history, dynamics, and physical setting of the continent's plant cover . . . a text and a reference for field scientists at all levels . . . it is unsurpassed as a guide to the vegetation blanketing North America and to the processes structuring that vegetation."

– *Ecology*

" . . . will be the standard reference on North American plant communities for quite some time."

– *BioScience*

Michael G. Barbour is Professor of Plant Ecology at the University of California, Davis. He is co-author of *Terrestrial Plant Ecology, Second Edition* (Benjamin/Cummings, 1987) and *Terrestrial Vegetation of California, Second Edition* (California Native Plant Society, 1988).

William Dwight Billings (1910–1997) has provided inspiration, advice, example, argument, and encouragement to generations of students and professionals in plant ecology. Professor Billings's love of nature and dedication to the study of ecology have been passed on to 52 men and women who received their Ph.D.'s under his direction.

© Cambridge University Press www.cambridge.org

CAMBRIDGE

Cambridge University Press
978-0-521-55986-7 - North American Terrestrial Vegetation, Second Edition
Edited by Michael G. Barbour and William Dwight Billings
Frontmatter
More information

Generalized vegetation formations of North America. A=ice; B=arctic tundra; C=taiga; D=Pacific coastal–Cascadian forests; E=Palouse prairies; F=Intermountain deserts, shrub-steppes, woodlands, and forests; G=Californian forests and alpine vegetation; H=Californian grasslands, chaparral, and woodlands; I=Mojave and Sonoran deserts; J=Rocky Mountain forests and alpine vegetation; K=central prairies and plains; L=mixed deciduous forests; M=Chihuahuan deserts and woodlands; N=Appalachian forests; O=piedmont oak-pine forests; P=coastal plain forests, bogs, swamps, and strand; Q=tropical forests. Boundaries and formation names according to W. D. Billings; art by Christina Weber-Johnson.

© Cambridge University Press www.cambridge.org

CAMBRIDGE

Cambridge University Press
978-0-521-55986-7 - North American Terrestrial Vegetation, Second Edition
Edited by Michael G. Barbour and William Dwight Billings
Frontmatter
More information

North American Terrestrial Vegetation
Second Edition

Edited by

Michael G. Barbour
William Dwight Billings

CAMBRIDGE
UNIVERSITY PRESS

© Cambridge University Press www.cambridge.org

CAMBRIDGE

Cambridge University Press
978-0-521-55986-7 - North American Terrestrial Vegetation, Second Edition
Edited by Michael G. Barbour and William Dwight Billings
Frontmatter
More information

CAMBRIDGE UNIVERSITY PRESS
Cambridge, New York, Melbourne, Madrid, Cape Town, Singapore, São Paulo

Cambridge University Press
The Edinburgh Building, Cambridge CB2 8RU, UK

Published in the United States of America by Cambridge University Press, New York

www.cambridge.org
Information on this title: www.cambridge.org/9780521550277

© Cambridge University Press 1988, 2000

This publication is in copyright. Subject to statutory exception
and to the provisions of relevant collective licensing agreements,
no reproduction of any part may take place without the written
permission of Cambridge University Press.

First published 1988
Second edition 2000

A catalogue record for this publication is available from the British Library

Library of Congress Cataloguing in Publication data
North American terrestrial vegetation / edited by Michael G. Barbour,
William Dwight Billings. – 2nd ed.
p. cm.
Includes bibliographical references (p.) and index.
ISBN 0-521-55027-0 (hardbound)
1. Plant communities – North America. 2. Plant ecology – North
America. 3. Phytogeography – North America. I. Barbour, Michael G.
II. Billings, W. D. (William Dwight), 1910–1997.
QK110.N854 1999
581.7'22'097 – dc21 97-29061
CIP

ISBN 978-0-521-55027-7 hardback
ISBN 978-0-521-55986-7 paperback

Transferred to digital printing 2007

© Cambridge University Press www.cambridge.org

CAMBRIDGE

Cambridge University Press
978-0-521-55986-7 - North American Terrestrial Vegetation, Second Edition
Edited by Michael G. Barbour and William Dwight Billings
Frontmatter
More information

Contents

	Contributors	page vii
	Preface to the First Edition	ix
	Preface to the Second Edition	xi
CHAPTER 1	**Arctic Tundra and Polar Desert Biome** *Lawrence C. Bliss*	1
CHAPTER 2	**The Taiga and Boreal Forest** *Deborah L. Elliott-Fisk*	41
CHAPTER 3	**Forests and Meadows of the Rocky Mountains** *Robert K. Peet*	75
CHAPTER 4	**Pacific Northwest Forests** *Jerry F. Franklin and Charles B. Halpern*	123
CHAPTER 5	**Californian Upland Forests and Woodlands** *Michael G. Barbour and Richard A. Minnich*	161
CHAPTER 6	**Chaparral** *Jon E. Keeley*	203
CHAPTER 7	**Intermountain Valleys and Lower Mountain Slopes** *Neil E. West and James A. Young*	255
CHAPTER 8	**Warm Deserts** *James A. MacMahon*	285
CHAPTER 9	**Grasslands** *Phillip L. Sims and Paul G. Risser*	323
CHAPTER 10	**Eastern Deciduous Forests** *Hazel R. Delcourt and Paul A. Delcourt*	357
CHAPTER 11	**Vegetation of the Southeastern Coastal Plain** *Norman L. Christensen*	397
CHAPTER 12	**Freshwater Wetlands** *Curtis J. Richardson*	449
CHAPTER 13	**Saltmarshes and Mangroves** *Irving A. Mendelssohn and Karen L. McKee*	501
CHAPTER 14	**Alpine Vegetation** *William Dwight Billings*	537
CHAPTER 15	**Mexican Temperate Vegetation** *Alejandro Velázquez, Victor Manuel Toledo, and Isolda Luna*	573
CHAPTER 16	**The Caribbean** *Ariel E. Lugo, Julio Figueroa Colón, and Frederick N. Scatena*	593
CHAPTER 17	**Tropical and Subtropical Vegetation of Mesoamerica** *Gary S. Hartshorn*	623

© Cambridge University Press www.cambridge.org

CAMBRIDGE

Cambridge University Press
978-0-521-55986-7 - North American Terrestrial Vegetation, Second Edition
Edited by Michael G. Barbour and William Dwight Billings
Frontmatter
More information

CHAPTER 18 **Vegetation of the Hawaiian Islands** 661
Lloyd L. Loope

Subject Index 689
Species Index 695

© Cambridge University Press www.cambridge.org

CAMBRIDGE

Cambridge University Press
978-0-521-55986-7 - North American Terrestrial Vegetation, Second Edition
Edited by Michael G. Barbour and William Dwight Billings
Frontmatter
More information

Contributors

Michael G. Barbour
Environmental Horticulture Department
University of California
Davis, California

William Dwight Billings (deceased)
Botany Department
Duke University
Durham, North Carolina

Lawrence C. Bliss
Botany Department
University of Washington
Seattle, Washington

Norman L. Christensen, Dean
Nicholas School of the Environment
Duke University
Durham, North Carolina

Julio Figueroa Colón
International Institute of Tropical Forestry
USDA Forest Service

Hazel R. Delcourt
Ecology and Evolutionary Biology Department
University of Tennessee
Knoxville, Tennessee

Paul A. Delcourt
Ecology and Evolutionary Biology and the Geological Sciences Departments
University of Tennessee
Knoxville, Tennessee

Deborah L. Elliott-Fisk
Wildlife, Fish, and Conservation Biology
University of California
Davis, California

Jerry F. Franklin
College of Forest Resources
University of Washington
Seattle, Washington

Charles B. Halpern
College of Forest Resources
University of Washington
Seattle, Washington

Gary S. Hartshorn
Organization for Tropical Studies
Duke University
Durham, North Carolina

Jon E. Keeley
Biological Resources Division
Sequoia-Kings Canyon Field Station
Three Rivers, California

Lloyd L. Loope
Geological Survey, Biological Resources Division
Pacific Island Ecosystem Research Center
Haleakala Field Station
Makawao Maui, Hawaii

Ariel E. Lugo
International Institute of Tropical Forestry
USDA Forest Service

Isolda Luna
Herbario, Facultad de Ciencias
Universidad Nacional Autonoma de México
Mexico DF, Mexico

James A. MacMahon, Dean
College of Biological Sciences
Utah State University
Logan, Utah

Karen L. McKee
National Wetlands Research Center
Lafayette, Louisiana

Irving A. Mendelssohn
Wetland Institute
Louisiana State University
Baton Rouge, Louisiana

© Cambridge University Press www.cambridge.org

CAMBRIDGE

Cambridge University Press
978-0-521-55986-7 - North American Terrestrial Vegetation, Second Edition
Edited by Michael G. Barbour and William Dwight Billings
Frontmatter
More information

Richard A. Minnich
Earth Sciences Department
University of California
Riverside, California

Robert K. Peet
Biology Department
University of North Carolina
Chapel Hill, North Carolina

Curtis J. Richardson
Nicholas School of the Environment
Duke University
Durham, North Carolina

Paul G. Risser, President
Oregon State University
Corvallis, Oregon

Frederick N. Scatena
Institute of Tropical Forestry
Rio Piedras, Puerto Rico

Phillip L. Sims
Southern Plains Range Research Station
U.S. Department of Agriculture
Woodward, Oklahoma

Victor Manuel Toledo
Centro de Ecologia
Universidad Nacional Autonoma de México
Mexico DF, Mexico

Alejandro Velázquez
Laboratorio de Biogeografia
Facultad de Ciencias, Universidad Nacional Autonoma de México
Mexico DF, Mexico

Neil E. West
Range Science Department
Utah State University
Logan, Utah

James A. Young
Agricultural Research Service
U.S. Department of Agriculture
Reno, Nevada

© Cambridge University Press www.cambridge.org

CAMBRIDGE

Cambridge University Press
978-0-521-55986-7 - North American Terrestrial Vegetation, Second Edition
Edited by Michael G. Barbour and William Dwight Billings
Frontmatter
More information

Preface to the First Edition

Rather naively, back in the fall of 1982, when this book first began to be organized, we expected to have a 300-page publication in hand three years later. The complexity of the subject and the intricate schedules of fourteen contributing authors and two editors lengthened the preparation period by 100% and increased the size of the book by 50%. We were helped in our early discussions about the book's content, format, and contributors by the hard work and encouragement of Richard Ziemacki, then editor at the New York office of Cambridge University Press. We thank him now for his vision when ours was still in the "what if . . ." stage.

We reached final decisions about book objectives, format, and the list of contributors by mid-1983. But the distribution of fine-scale topics was in a state of dynamic equilibrium well into 1986. Book writing, it seems, is a seral procedure, with many analogies to succession in vegetation. We trust that the climax presented to the reader is an accurate and challenging summary of what is currently understood about North American vegetation.

Chapters focus on the major plant formations of North America, but they also include information on many other, more local, vegetation types. The authors have devoted enough attention to each vegetation type discussed to give the reader details on vegetation structure, response to disturbance, community/environment relations, nutrient cycling and productivity, and autecological behavior of dominant species. We have selected contributors who are active researchers in extensive regions or vegetation types, and we have invited them to flavor their reviews with their own research biases (many chapters include previously unpublished data, analyses, or models). The same standard topical outline was given to each author to follow, but each region or vegetation type has a peculiarly skewed literature that reflects the environmental factors long considered to be important by regional ecologists. In one area, those factors may be fire and soil moisture; in another, wind storms and soil nutrients; in another, paleoecological events of the Pleistocene or Holocene; in another, human actions that have introduced grazing animals or weeds or modified the scale of natural disturbances. Consequently, any two chapters may have little in common beyond starting with a frontispiece map and introduction and concluding with suggestions for future research. Although the sequences of topics vary from chapter to chapter, each chapter includes sections of paleobotany, the modern environment, human-caused vegetation changes, successional patterns following disturbance, and a quantitative description of major vegetation types.

There is some overlap, in terms of vegetation types discussed, between pairs of chapters. Petran chaparral, for example, is described in Chapter 3 (Rocky Mountains), Chapter 6 (chaparral), and Chapter 7 (intermountain deserts, shrub steppes, and woodlands); the New Jersey pine barrens are considered in both Chapter 10 (deciduous forest) and Chapter 11 (southeastern coastal plain); the forest-tundra ecotone is discussed in both Chapter 1 (arctic tundra and polar desert biome) and Chapter 2 (boreal forest). In the interest of efficient use of space, only one chapter of such a pair describes an overlapping vegetation unit in detail, but the units are such logical inclusions within each chapter that the remaining degree of overlap is important to the book's overall objective and to the reader's understanding of vegetation gradients.

Our intended audience includes knowledgeable laypeople, advanced undergraduates, graduate students, and professional ecologists in both basic and applied fields. Every chapter addresses management questions and problems, and every chapter includes considerable information on basic ec-

© Cambridge University Press www.cambridge.org

CAMBRIDGE

Cambridge University Press
978-0-521-55986-7 - North American Terrestrial Vegetation, Second Edition
Edited by Michael G. Barbour and William Dwight Billings
Frontmatter
More information

ological topics, quite apart from immediate management considerations. Common names of dominant plants are sometimes used, but text, tables, and figures emphasize scientific names. The metric system is adopted exclusively. Figures and tables are added when they can efficiently convey a sense of the vegetation better than can the text. Space limitations prevent us from illustrating every vegetation type included in the text, and some types simply do not lend themselves well to black-and-white photography. Some of the graphs in the text were drawn by Christina Weber-Johnson.

There is a rich heritage of texts on North American vegetation, and we stand on the shoulders of their authors in order to see just a bit farther. Our predecessors include Clements, Daubenmire, Harshberger, Knapp, Küchler, and Vankat; their works span the past 75 years. Most recently, Chabot and Mooney have edited a volume on the physiological ecology of North American vegetation, and we consider their work to be an appropriate complementary companion to this book.

Many colleagues have served as reviewers for portions of this book, and we take this opportunity now to thank them. We also congratulate the authors on the care and effort with which they have created their chapters, and we anticipate that these chapters will stand as the best summaries for some years to come. Quite simply, we believe that the authors have made this text a balanced, modern, detailed reference work that has had no equal in the past and that certainly has no current equal.

Finally, we deeply appreciate the help of the following people for their work in indexing: Julie Barbour, Frederika Bowcutt, Robert Boyd, Sonia Cook, Ronnie James, Steven Jennings, Scott Martens, Tisa Owen, Wayne Owen, Oren Pollack, Robert Rhode, George Robinson, Diane Ryerson, Jane Sakauye, Judy Sindel-Dorsey, Glenn Turner, and Debbie Woodward. Mrs. Judi Steinig was invaluable to us in the production aspects of this book; we are indebted to her for the exceptional care she consistently applied to our project.

MGB. and WDB.

© Cambridge University Press www.cambridge.org

CAMBRIDGE

Cambridge University Press
978-0-521-55986-7 - North American Terrestrial Vegetation, Second Edition
Edited by Michael G. Barbour and William Dwight Billings
Frontmatter
More information

Preface to the Second Edition

When Dwight Billings and I finished checking the last proofs of *North American Terrestrial Vegetation* in 1988, we never expected to visit the process again — let alone within 10 years. However, that book became so well and widely received that the publisher asked us to write a second edition. We undertook the project with the proviso that our first effort might be expanded as well as updated.

The expansion has been in (1) breadth of vegetation types and (2) an additional theme that all chapters embrace. This second edition contains new chapters on freshwater wetlands, coastal marine wetlands, temperate Mexico, the Caribbean Islands, and the Hawaiian Islands. Every chapter, whether new or among the original 13, now includes information on habitat loss and the restoration and preservation programs that are mitigating these losses. First edition chapters have all been variously revised, some completely, but all have new tables, illustrations, chapter sections, and references. Some chapters have been written by new authors or co-authors, in this way injecting different perspectives.

In early January of 1997, near the very end of manuscript preparation, Dwight Billings passed away. His academic life has recently been well chronicled by Boyd Strain (*Bulletin of the Ecological Society of America,* April, 1997 issue), so there is no need to review here his enormous impact on American plant ecology. Rather, those of us who have participated in this edition simply want to say that we miss him and hope that our work will serve as a testimonial to his influence in our lives. Fittingly, we have chosen a painting of Dwight's for the book's jacket. It is a pastel he did at the age of 36, of quaking aspen (*Populus tremuloides*) in the Sierra Nevada. Because aspen is the tree species with the widest distribution in North America, the painting provides a fitting ecological – as well as personal – motif for our book to wear.

We dedicate this volume to Shirley Miller Billings, Dwight's wife of 38 years. As Boyd Strain so well recalls in his obituary, Shirley and Dwight were a research *team*.

Finally, we thank our many reviewers for their careful reading of various chapters and their helpful comments. We also thank Ms. Judi Steinig, who once again served as production editor.

© Cambridge University Press www.cambridge.org