Temporal Dynamics and Ecological Process

In contrast with the fundamental ecological expectation that similarity induces competition and loss of species, temporal dynamics allow similar species to co-occur. In fact, the coexistence of similar species contributes significantly to species diversity and could affect ecosystem response to climate change. However, because temporal processes take place over time, they have often been a challenge to document or even to identify.

Temporal Dynamics and Ecological Process brings together studies that have met this challenge and present two specific aspects of temporal processes: reproductive scheduling and the stable coexistence of similar species. By using plants to extract general principles, these studies uncover deep ties between temporal niche dynamics and the above central ecological issues, thereby providing a better understanding of what drives temporal processes in nature.

Written by leading scientists in the field, this title will be a valuable source of reference to research ecologists and to those interested in temporal ecology.

COLLEEN K. KELLY is a Senior Research Associate in the Department of Zoology at the University of Oxford. Her research interests focus on temporal dynamics, community assembly and ecosystem function. She has published widely on these topics and has been a principal investigator or co-PI on various funded projects in the United States, the UK and México.

MICHAEL G. BOWLER has worked in the Department of Physics at the University of Oxford for over 40 years. His research interest focused on particle physics. He has taken part in several major collaborations in this field, most recently the Sudbury Neutrino Observatory. He has authored or co-authored 150 papers and has written five books.

GORDON A. FOX is Associate Professor in the Department of Integrative Biology at the University of South Florida. His main area of research is plant ecology and theoretical population biology. His recent work has focused on demographic heterogeneity and its causes and consequences, including both theoretical studies and research with populations of pines, lilies and Florida scrub-jays.
Temporal Dynamics and Ecological Process

Edited by

COLLEEN K. KELLY
University of Oxford, UK

MICHAEL G. BOWLER
University of Oxford, UK

GORDON A. FOX
University of South Florida, USA
## Contents

List of contributors

<table>
<thead>
<tr>
<th>Chapter</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Introduction</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td><strong>Colleen K. Kelly, Michael G. Bowler and Gordon A. Fox</strong></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>The storage effect: definition and tests in two plant communities</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td><strong>Peter Chesson, Nancy J. Huntly, Stephen H. Roxburgh, Marissa Fantastico-Caldas and Jose M. Facelli</strong></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>What temporal processes in trees tell us about competition, community structure and speciation</td>
<td>41</td>
</tr>
<tr>
<td>4</td>
<td>Testing the storage effect with long-term observational data</td>
<td>82</td>
</tr>
<tr>
<td></td>
<td><strong>Peter B. Adler</strong></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Seedling herbivory and the temporal niche</td>
<td>102</td>
</tr>
<tr>
<td></td>
<td><strong>Mick E. Hanley and Rebecca J. Sykes</strong></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Temporal variation in density dependence in an herbaceous community</td>
<td>123</td>
</tr>
<tr>
<td></td>
<td><strong>Norma L. Fowler and Craig M. Pease</strong></td>
<td></td>
</tr>
</tbody>
</table>
## Contents

<table>
<thead>
<tr>
<th>Chapter</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>Population and community dynamics in variable environments: the desert annual system</td>
<td>140</td>
</tr>
<tr>
<td></td>
<td><strong>D. Lawrence Venable and Sarah Kimball</strong></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Temporal niches, ecosystem function and climate change</td>
<td>165</td>
</tr>
<tr>
<td></td>
<td><strong>Susanne Schwinning, Gordon A. Fox and Colleen K. Kelly</strong></td>
<td></td>
</tr>
<tr>
<td>Part II</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Evolution of synchronised and intermittent reproduction (masting) of trees: key role of regeneration dynamics</td>
<td>191</td>
</tr>
<tr>
<td></td>
<td><strong>Yoh Iwasa, Akiko Satake and Yuuya Tachiki</strong></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Spatiotemporal variation can promote coexistence more strongly than temporal variation</td>
<td>224</td>
</tr>
<tr>
<td></td>
<td><strong>Robin E. Snyder</strong></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Roles of pollinator attraction and environmental fluctuation in inducing flowering synchrony</td>
<td>251</td>
</tr>
<tr>
<td></td>
<td><strong>Akiko Satake, Yuuya Tachiki and Yoh Iwasa</strong></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Temporal dynamics and the spread of insect resistance transgenes</td>
<td>282</td>
</tr>
<tr>
<td></td>
<td><strong>Michael G. Bowler, Felix Breden and Colleen K. Kelly</strong></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Concluding remarks</td>
<td>309</td>
</tr>
<tr>
<td></td>
<td><strong>Gordon A. Fox, Michael G. Bowler and Colleen K. Kelly</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Index</td>
<td>321</td>
</tr>
</tbody>
</table>
Contributors

Peter B. Adler
Utah State University, College of Natural Resources,
5230 Old Main Hill, Logan, UT 84322–5230, USA

Michael G. Bowler
Department of Physics, University of Oxford, Keble Road,
Oxford, OX1 3RH, UK

Felix Breden
Department of Biological Sciences, Simon Fraser University,
Burnaby, British Columbia, V5A 1S6, Canada

Peter Chesson
Department of Ecology and Evolutionary Biology,
University of Arizona, Tucson, AZ 85721, USA

Jose M. Facelli
Terrestrial Plant Ecology, School of Earth and Environmental Sciences, The University of Adelaide, SA 5005, Australia

Norma L. Fowler
The University of Texas at Austin, Section of Integrative Biology, 1 University Station A6700, Austin, TX 78712, USA

Gordon A. Fox
Department of Integrative Biology, University of South Florida, 4202 E. Fowler Ave, Tampa, FL 33620, USA

Mick E. Hanley
School of Biological Sciences, University of Plymouth,
Drake Circus, Plymouth, PL4 8AA, UK
List of contributors

Nancy J. Huntly
Director, USU Ecology Center, Utah State University, 5205 Old Main Hill, Logan, UT 84322–5205, USA

Yoh Iwasa
Department of Biology, Faculty of Sciences, Kyushu University, Fukuoka, Japan

Jeffrey B. Joy
Department of Biological Sciences, Simon Fraser University, Burnaby, British Columbia, V5A 1S6, Canada

Colleen K. Kelly
Department of Zoology, Niko Tinbergen Building, South Parks Road, Oxford, OX1 3PS, UK

Sarah Kimball
University of California, Irvine BIO SCI – Center for Environmental Biology, Irvine, CA 92697–1450, USA

Pilar Lopera Blair
Department of Integrative Biology, University of South Florida, 4202 E. Fowler Ave, Tampa, FL 33620, USA

Marissa Fantastico-Caldas
Science Department, Los Angeles Trade-Tech College, 400 W. Washington Blvd, Los Angeles, CA 90015, USA

Craig M. Pease
Vermont Law School, Environmental Law Center, S Royalton, VT 05068, USA

J. Marcela Ramos-Tapia
Plan de Ayala #87, Francisco Villa, Municipio de La Huerta, Jalisco, C.P. 48878, México

Stephen H. Roxburgh
CSIRO Sustainable Ecosystems, GPO Box 284, Canberra, ACT 2601, Australia

Akiko Satake
Hokkaido University, Graduate School of Environmental Science, Sapporo, Hokkaido 0600810, Japan
List of contributors

Susanne Schwinning
Department of Biology, Texas State University, San Marcos, TX 78666, USA

Robin E. Snyder
Department of Biology, Case Western Reserve University, 10900 Euclid Avenue, Cleveland, OH 44106–7080, USA

J. Arturo Solís-Magallanes
Laboratorio de Botánica del Departamento de Ecología y Recursos Naturales, Centro Universitario Costa Sur, Universidad de Guadalajara, Avenida Independencia # 151 Autlán, Jalisco, C.P. 48 900, México

Rebecca J. Sykes
Principal Ecological Consultant, Ecological Planning & Research Ltd, The Barn, Micheldever Station, Winchester, SO21 3AR, UK

Yuuya Tachiki
Kyushu University, Faculty of Science, Department of Biology, Fukuoka 8128581, Japan

D. Lawrence Venable
Department of Ecology and Evolutionary Biology, University of Arizona, Tucson, AZ 85721, USA

John N. Williams
Environmental Science & Policy, University of California, One Shields Avenue, Davis, CA 95616, USA