

University of Padova – Programme Forest Science
2014-2015

Course: Insect ecology and management



Prof. Andrea Battisti

DAFNAE - Entomologia

Agripolis: seconda stecca, secondo piano

e-mail: andrea.battisti@unipd.it

telefono: 049 8272804

fax: 049 8272810



Syllabus

| | |
|-------------------------------------|--|
| Prerequisites: | Basic knowledge of ecology and entomology. |
| Target skills and knowledge: | The aim of the course is to provide students with basic knowledge of insect ecology, with particular interest for the species causing epidemics in the forest. The insect-plant relationships and the tritrophic relationships with the natural enemies will be explored. Possible applications to the integrated pest management of key species in forest ecosystems will be considered. The role of climate change and invasive species will be addressed. |
| Examination methods: | The exam will consist of written reports on the laboratory/field activity done during the course as well as of an oral presentation on a subject agreed with the teacher. |
| Assessment criteria: | The assessment of the student will be carried out based on the general understanding of both theoretical and practical subjects. |

Course contents:

- 1. Insect abundance and distribution: species-area relationships. Diversity of forest insects in relation to tree species, feeding guilds, and to the history of forest stands. Invasive species in forestry: definitions, concepts, and applications.**
- 2. Classification of the outbreaks and related examples. Population dynamics: demographic growth versus mortality. Population cycles in different types of forest ecosystems.**
- 3. Ecological factors affecting the populations of forest insects. --Effects of climate and temperature, including climate change. Mechanisms of resistance developed by the host plants and adaptations of the insects. Role of competition and of natural enemies in population regulation.**
- 4. Principles of integrated pest managements based on the knowledge of the insect ecology. Prevention, direct and indirect control, economic assessment of costs and benefits of IPM in forestry.**

Planned learning activities and teaching methods:

The course will include 32 hours of theoretical teaching as well as 16 hours of practical work, done in both the laboratory and in the field.

Additional notes about suggested reading:

The material used for the course will be made available to students through the Moodle platform of the School at

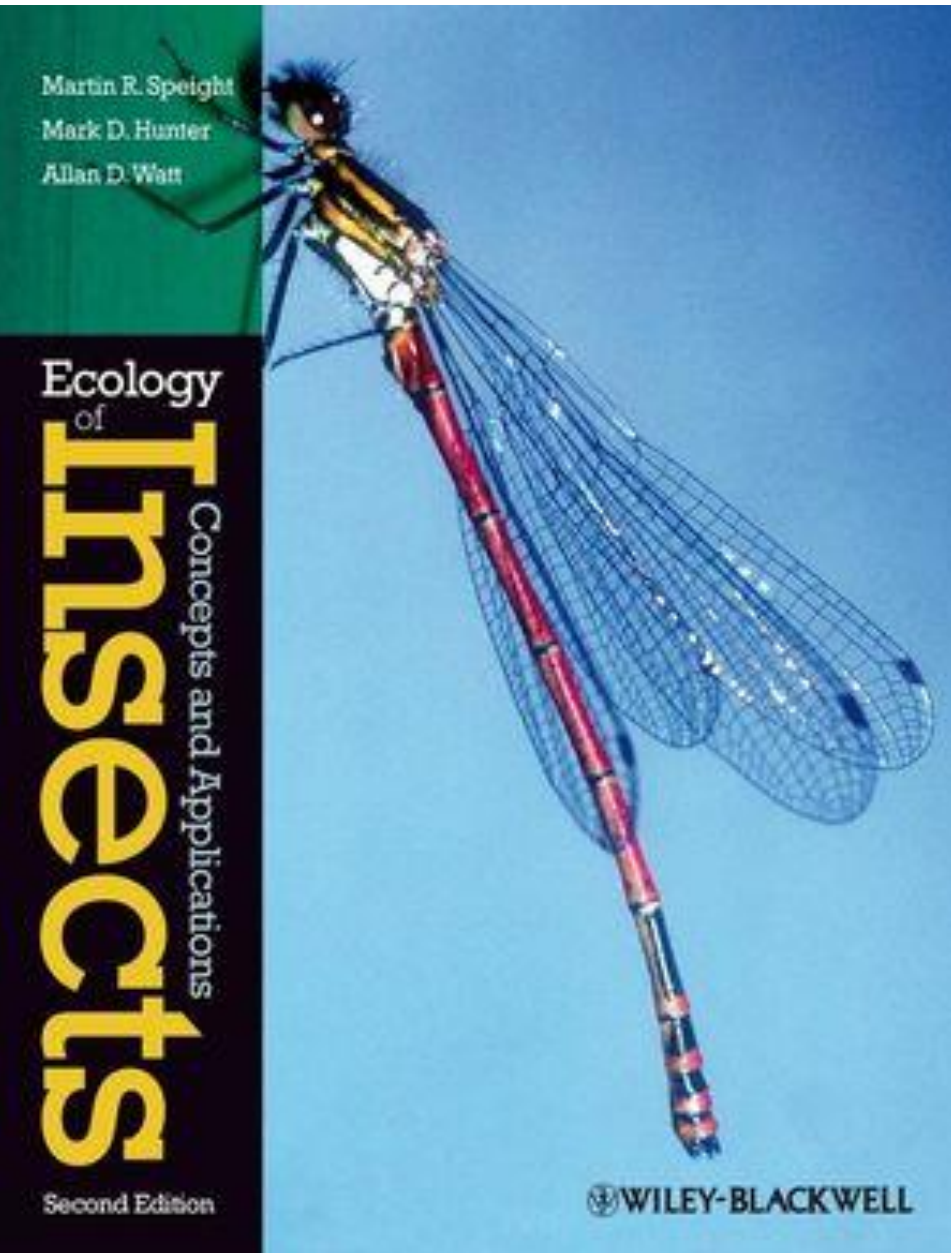
<https://elearning.unipd.it/scuolaamv/login/index.php>

The students may contact the teacher through the forum available on the Moodle platform or by e mailing andrea.battisti@unipd.it

Textbooks (and optional supplementary readings)

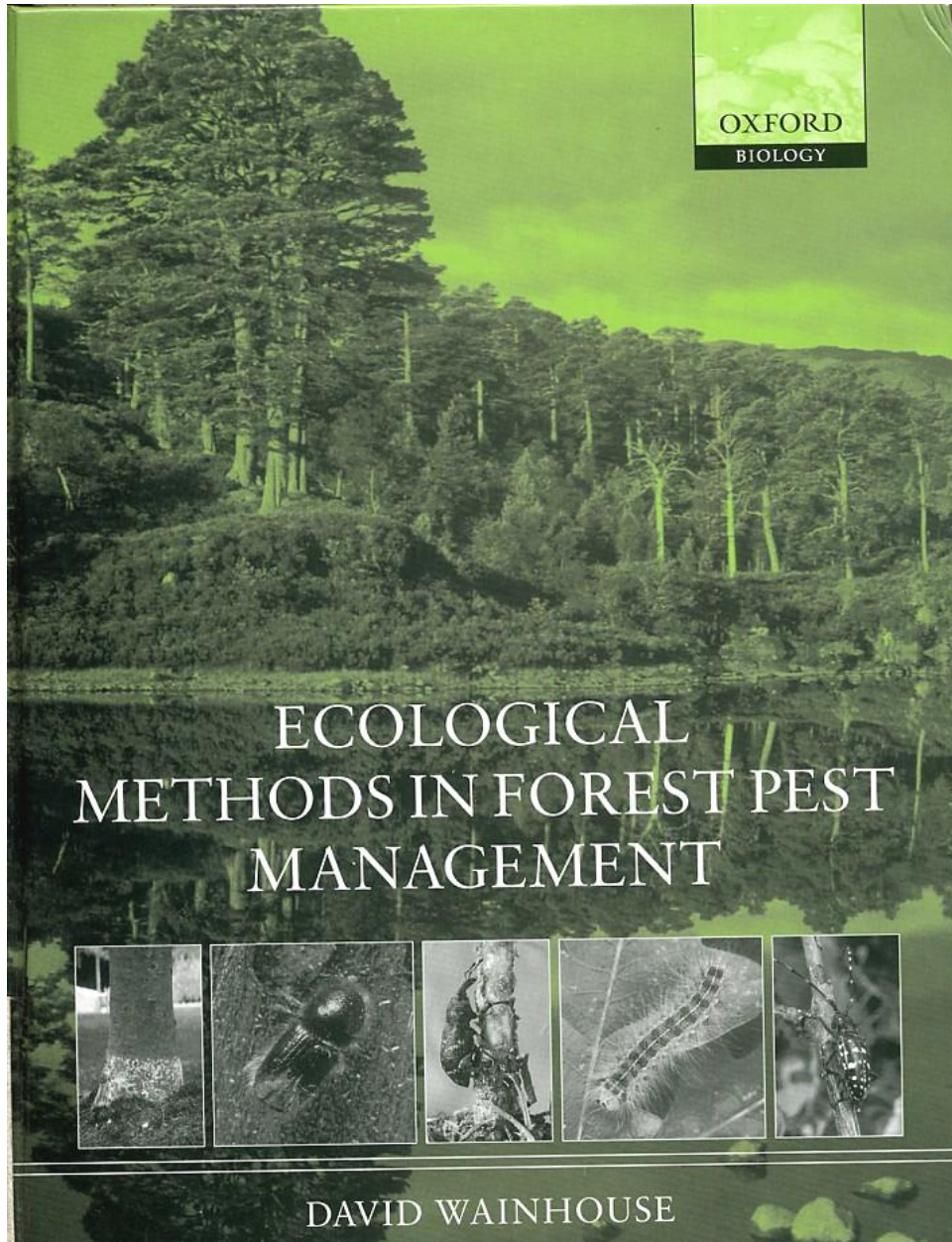
- Speight M., Hunter M., Watt A., Ecology of Insects. Concepts and Applications. London: Blackwell, 2008.
- Wainhouse D., Ecological methods in forest pest management. Oxford: Oxford UP, 2005.

Textbooks



1. An Overview of Insect Ecology.
2. Insects and Climate.
3. Insect Herbivores.
4. Resource Limitation.
5. Natural Enemies and Insect Population Dynamics.
6. Evolutionary Ecology.
7. Physiological Ecology.
8. Insects in Ecosystems.
9. Biodiversity.
10. Insect Conservation.
11. Insects and Diseases.
12. Insect Pest Management.

Textbooks



Chapter 1 Forests and pest management

Chapter 2 Plant health

Chapter 3 Risk, monitoring and prediction

Chapter 4 The role of silviculture

Chapter 5 Resistance to attack by pests and pathogens

Chapter 6 Biological control

Chapter 7 Microbial control

Chapter 8 Semiochemicals

Chapter 9 Integrated pest management

Textbooks



PART I PHYSIOLOGY AND LIFE HISTORY PERSPECTIVES 1

1 Insect Herbivore Outbreaks Viewed through a Physiological Framework: Insights from Orthoptera 3

Spencer T. Behmer and Anthony Joern

2 The Dynamical Effects of Interactions between Inducible Plant Resistance and Food Limitation during Insect Outbreaks 30

Karen C. Abbott

3 Immune Responses and Their Potential Role in Insect Outbreaks 47

J. Gwen Shlichta and Angela M. Smilanich

4 The Role of Ecological Stoichiometry in Outbreaks of Insect Herbivores 71

Eric M. Lind and Pedro Barbosa

PART II POPULATION DYNAMICS AND MULTISPECIES INTERACTIONS 89

5 Plant-Induced Responses and Herbivore Population Dynamics 91

André Kessler, Katja Poveda, and Erik H. Poelman

6 Spatial Synchrony of Insect Outbreaks 113

Andrew M. Liebhold, Kyle J. Haynes, and Ottar N. Bjørnstad

7 What Tree-Ring Reconstruction Tells Us about Conifer Defoliator Outbreaks 126

Ann M. Lynch

8 Insect-Associated Microorganisms and Their Possible Role in Outbreaks 155

Yasmin J. Cardoza, Richard W. Hofstetter, and Fernando E. Vega

PART III POPULATION, COMMUNITY, AND ECOSYSTEM ECOLOGY 175

9 Life History Traits and Host Plant Use in Defoliators and Bark Beetles: Implications for Population Dynamics 177

Julia Koricheva, Maartje J. Klapwijk, and Christer Björkman

10 The Ecological Consequences of Insect Outbreaks 197

Louie H. Yang

11 Insect Outbreaks in Tropical Forests: Patterns, Mechanisms, and Consequences 219

Lee A. Dyer, Walter P. Carson, and Egbert G. Leigh Jr.

12 Outbreaks and Ecosystem Services 246

Timothy D. Schowalter

PART IV GENETICS AND EVOLUTION 267

13 Evidence for Outbreaks from the Fossil Record of Insect Herbivory 269

Conrad C. Labandeira

14 Implications of Host-Associated Differentiation in the Control of Pest Species 291

Raul F. Medina

PART V APPLIED PERSPECTIVES 311

15 Disasters by Design: Outbreaks along Urban Gradients 313

Michael J. Raupp, Paula M. Shrewsbury, and Dan A. Herms

16 Resistance to Transgenic Crops and Pest Outbreaks 341

Bruce E. Tabashnik and Yves Carrière

17 Natural Enemies and Insect Outbreaks in Agriculture: A Landscape Perspective 355

J. Megan Woltz, Benjamin P. Werling, and Douglas A. Landis

18 Integrated Pest Management – Outbreaks Prevented, Delayed, or Facilitated? 371

Deborah K. Letourneau

19 Insect Invasions: Lessons from Biological Control of Weeds 395

Peter B. McEvoy, Fritz S. Grevstad, and Shon S. Schooler

20 Assessing the Impact of Climate Change on Outbreak Potential 429

Maartje J. Klapwijk, Matthew P. Avres, Andrea Battisti, and Stig Larsson