

NR506 – Forest Entomology

**Lecture: MWF 10:10-11am; Laboratory: W 8:10-10am,
James 140, 4 Credits**

Professor: Dr. Jeff Garnas

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Course description and objectives: Insects are critical components of biodiversity and major drivers of ecosystem function in nearly all terrestrial landscapes, including forests. Viewed through the right lens, the insect world is also astonishingly beautiful in its intricacy and complexity. A small subset of insect species – particularly in the context of human modification of the planet (i.e., biological invasion, climate change, intensive management) – have also become immensely damaging to forest trees and threaten the growth and yield and even the survival and persistence of natural and cultivated forest species. Insect parasitoids and predators are also important top-down regulators of forest insect populations and represent the best hope for the long-term management of non-native outbreaking species in the form of biological control. This course provides an overview of the biology, ecology, evolution and management of insects with specific focus on those that interact directly with forested landscapes or trees.

Specific learning objectives:

1. identify major forest insects to an appropriate taxonomic resolution (Order, family and occasionally genus, depending on the group in question)
2. classify insects by feeding guild, basic life history attributes, damage type (i.e., to trees) and key aspects of their ecology
3. contextualize insect biodiversity in light of major evolutionary adaptations within Class Insecta (and Phylum Arthropoda)
4. apply newly acquired knowledge and understanding of the biology and ecology of insects and associated interactions (insect-tree, insect-microbe, insect-insect, etc.) to issues of management

These four objectives will be achieved via **in-class lectures** (including a handful of guest presenters) as well as **hands-on laboratory activities** designed to acquaint students with key aspects of the discipline (i.e., field sampling and specimen curation, morphological variation and insect taxonomy and identification, and issues relevant to the study and management of focal insect species). A core component of the course is the development of a **high-quality, curated insect collection** which will further supplement class and laboratory activities and provide a keener eye (and hopefully appreciation) for insects in their many forms.

Featured Forest Creature (FFC): Each student will pick an insect of their choice (within specified parameters, details forthcoming) and explore its taxonomic placement, life history, ecology and role in forest ecosystems, along with cool and interesting aspects of its biology and/or interaction with human culture or commerce. Findings will be presented to the class on Fridays during 8-10-minute Bug Reports. These reports represent testable material so please provide notes (which will be posted on Canvas) and two potential exam questions which will not).

Insect collections: A significant part of your grade (20%) will be the collection, curation and correct identification of an insect collection. Details will be provided but the basic requirements are 50 insects including 10 orders, 35 families and 50 distinct species. You do not need to identify all of your insects to species but all major forest pests plus 5 common insects must be correctly identified, at least to genus.

A note on insect collections: Collecting insects (particularly in the adult life stage) is vastly easier in the warmer months. Considerable time will be needed to process samples and properly identify specimens and as such, your collections are *due at the end the semester (12/9)*. It is **HIGHLY** recommended for students to collect all of the required insects before leaf fall and/or the cold weather arrives, ideally in August/September. **Do not underestimate this task!** While with reasonable directed effort the collecting component of this project is a tractable one, this is NOT a task you want to leave until late in the semester. Even if you are prepared to fly to some tropical or Southern Hemisphere location to collect insects in November when their New Hampshire counterparts are dormant, identification and curation is a considerable, while important and fun, task!

Grade breakdown

Lecture exam	10%
Weekly quizzes	10% (1% each, drop 3)
FFC presentation and write-up	5%
Laboratory Exams (3)	30% (10% each)
Lab reports and assignments	10%
Insect Collection	20%
Final exam	15%
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Total	100%

Equipment

During the lab portion of the course, you will be issued several items of equipment. Your insect collection will not be accepted until your equipment is returned. Late submission of your collection will cost you points and could lead to an "incomplete" for the course.

Disability Services for Students

The University is committed to providing students with documented disabilities equal access to all university programs and facilities. If you think you have a disability requiring accommodations, you must register with Disability Services for Students (DSS). Contact DSS at (603) 862-2607 or visit them in Smith Hall 201. If you have received an Accommodation Letter for this course from DSS, please provide me with that information privately so that we can review them and discuss appropriate measures.

Textbooks and required materials:

Required: Cranshaw, W., & Redak, R. (2013). *Bugs rule! An introduction to the world of insects*. Princeton: Princeton University Press.

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Castner, J. L. 2000. *Photographic atlas of entomology and guide to insect identification*.

Recommended: Borror, D & White, R. 1998. *A Field Guide to Insects: America North of Mexico* 2nd edition. (or similar field guide)

Recommended for the zealots: Waldbauer, G. 1998. *Insects through the Seasons*. (Nice, easy reading and interesting introduction to insect biology and life history).

Quizzes: There will be regular quizzes on both lab and lecture materials. All will be short-format and should not take longer than 5 minutes. The lowest 3 marks will be dropped.

Attendance: You are responsible for regularly attending all lectures. There is no formal attendance list but in small classes such as this one it's pretty obvious when you're not there. There are no makeup quizzes (except under extenuating circumstances) as you can drop up to 3 during the semester Makeup exams are only allowed with a doctor's note or by prior arrangement with a valid excuse. There are no makeups for lab sections though spending extra time any of the specimens we examine this can usually be accommodated.

Course schedule and reading assignments: Refer to Canvas for updates/changes

Week	Date	Day	Lecture topic	Lab topic
1	8/30	Mon.	Introduction to Class Insecta; insects in forest ecosystems	
	9/1	Wed.	Arthropod diversity and classification	Introduction to the Insects and non-Insect Arthropods
	9/3	Fri.	Insect diversity and classification	
2	9/6	Mon.	NO CLASS, Labor Day	
	9/8	Wed.	The insect body plan	Sampling and collecting methods
	9/10	Fri.	Insect integument	
3	9/13	Mon.	Reproduction: behavior and physiology	
	9/15	Wed.	Development / Intro. to insect sampling methods	The care and feeding of a quality insect collection / Sample sorting and data capture
	9/17	Fri.	Reproduction: behavior and physiology	
4	9/20	Mon.	Integrated Pest Management	
	9/22	Wed.	Collections and curation	External anatomy: the insect body plan
	9/24	Fri.	Forest Insect Monitoring, life as a Research Entomologist (Guest lecture, Kevin Dodds, USFS)	

Week	Date	Day	Lecture topic	Lab topic
5	9/27	Mon.	Insect life cycles	
	9/29	Wed.	Insect movement	Acoustic detection of insects
	10/1	Fri.	Excretion, respiration and circulation	
6	10/4	Mon.	Nutrition and digestion	
	10/6	Wed.	Insect nervous and sensory system	Practical exam 1; Internal anatomy: what's inside that bug
	10/8	Fri.	Insect communication	
7	10/11	Mon.	NO CLASS, Mid-semester break	
	10/13	Wed.	Major and minor Orders I	The major orders; make a key
	10/15	Fri.	Major and minor Orders II	
8	10/18	Mon.	Lecture exam 1	
	10/20	Wed.	Insects and plants I: Patterns and consequences	The minor orders
	10/22	Fri.	Insects and plants II: Co-evolution	
9	10/25	Mon.	Insect behavior I	
	10/27	Wed.	Insect behavior II	Immature insects, Signs and symptoms of insect damage
	10/29	Fri.	Sociality in insects	
10	11/1	Mon.	Population ecology of insects I	
	11/3	Wed.	Population ecology of insects II	Practical exam 2; Families of the Hemiptera
	11/5	Fri.	Root feeding insects	
11	11/8	Mon.	Stem boring bark beetles	
	11/10	Wed.	Wood boring insects	Families of the Coleoptera
	11/12	Fri.	Defoliators	
12	11/15	Mon.	Shoot and tip feeding insects	
	11/17	Wed.	Pollination	Families of the Hymenoptera and Neuroptera
	11/19	Fri.	Entomophagy and parasitism	
13	11/22	Mon.	Disease transmission	
14	11/29	Mon.	Community ecology	
	12/1	Wed.	Insect symbiosis and mutualism	Families of the Diptera and Lepidoptera
	12/3	Fri.	Natural enemies of insects	
15	12/6	Mon.	Medical and veterinary entomology	
	12/8	Wed.	Insect genetics	Practical exam 3; Edible Insect Party
	12/10	Fri.	Current topics in entomology	
16	12/13	Mon.	Course review	
	12/20	Mon.	Final Exam (10:30-12:30pm)	