

Syllabus

BSCI 145 “The Insect Apocalypse: Real or Imagined?”

Spring, 2023 (rev 1/18/2023)

“To a person uninstructed in natural history, his country or seaside stroll is a walk through a gallery filled with wonderful works of art, nine-tenths of which have their faces turned to the wall.” - Thomas Henry Huxley (1854)

“Here is the means to end the great extinction spasm. The next century will, I believe, be the era of restoration in ecology.” – E.O. Wilson, “The Diversity of Life” (1992)

“There are three principal means of acquiring knowledge... observation of nature, reflection, and experimentation. Observation collects facts; reflection combines them; experimentation verifies the result of that combination.” - Denis Diderot (1713-1784)



Bumblebee (Hymenoptera: Bombidae)

Course Description

An article in the New York Times, in 2018, declared an “Insect Apocalypse” that for the first time brought the signs of general, unexplained reductions in insect abundance to the public and suggested a catastrophe awaits our planet. Scientists have long documented the loss of species of insects at a rate exceeding the extinction rates associated with the major geological events in the Earth’s history. The “insect apocalypse”, more generally called the “insect decline in abundance” among researchers, was much more surprising and potentially could lead to the demise of all terrestrial and freshwater ecosystems. The course will start with the New York Times article as well as the preceding research publication by Hallman et al. (2017) that provided the evidence for the decline of insect biomass. Based on science and research, students will be provided background, and discover on their own, the diversity of the form and functions of insects, as well as how they evolved and persisted for 400 million years. The course, designed for students of any major, celebrates the incredible variation of insect life and what they do to support life on our planet. Beneficial insects, like pollinators, natural enemies, and decomposers play important roles to maintain sustainable conditions in their contribution to ecosystem services. In contrast, injurious insects must be managed appropriately for the health and well-being of mankind without harming the environment. The course will highlight the use of scientific research to understand and respond to the global crisis, using original research articles and examples of current research. Science writing, as a way to address the public on scientific research, will be discussed and included as an assignment. The options for responding to the decline will be discussed with the inclusion of guest speakers. At the end of the course, we will again reflect on the New York Time article, and address the science of and response to the decline of insects.



Assassin bug (Hemiptera: Reduviidae)



Paint Branch, adjacent to UMD campus

The Focal Question and Approach

The rich diversity of insect life is at risk from high extinction rates and measured losses in total biomass. How can scientific research identify and provide solutions to the problem of the insect apocalypse? In addition, how can science writers inform the public of the issue and its solution? As a lab course designed for students of any major, the course will celebrate the dominance and incredible variety of insects on our planet, as well as their value to society as providers of ecosystem services. Discussions will focus on sustainability, and the role of conservation and restoration to ensure the future of insects (and us) on our planet.

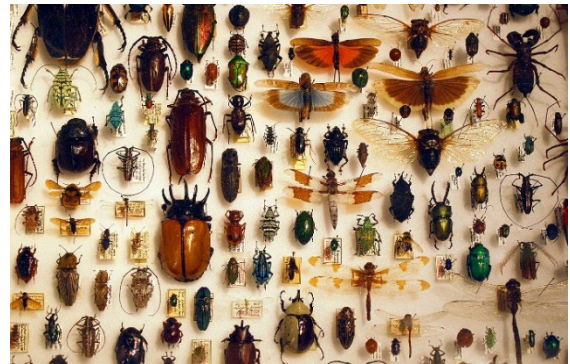
Instructor (Office hours by appointment.)

Dr. Bill Lamp, Professor

Department of Entomology

4138 Plant Sciences Building

Use email to contact Dr. Lamp: lamp@umd.edu



Learning Outcomes

After successfully completing this course you will be able to:

1. Explain the concept of biodiversity in relation to insect life on Earth.
2. Define the issues surrounding the observed decline of insect species and their populations, especially with regard to ecosystem services.
3. Apply the scientific method to issues relating to insect biodiversity and ecosystems.
4. Relate new knowledge derived from original research articles on the status of biodiversity and human impact
5. Contrast communication of scientific discoveries among researchers to science writing provided to the public.

Location and Time

The lecture/discussion are scheduled at 1:00-1:50 on Mondays, Wednesdays, and Fridays. The weekly lab will meet at 2:00-5:00 on Wednesdays. Both lecture and lab will meet in the Entomology Teaching Lab, PLS 1161.

Frequency of Offering
Each spring semester.

Class Size
Enrollment is limited to 24 students because of limited access to laboratory functions.

General Education Category
The course provides credit within the Natural Sciences category of General Education, DSLS.



Required Resources

- *Course Website:* elms.umd.edu. On ELMS for BSCI 145, under “Modules”, each week is listed and defined by a theme. Within each module, there is a file of “Resources”, which include a paragraph describing the theme in relation to events for the week. In addition, under “Resources”, students will find lecture slides, readings, podcasts, and videos. The lab is also described. Within the weekly modules, assignments are also posted.
- *Required text:* An insect identification field handbook. I strongly suggest: Eaton, E.R., and K. Kaufman. 2007. Kaufman Field Guide to Insects of North America. Houghton Mifflin Co., New York. 391 pp. ISBN: 0-618-15310-1. Available through Amazon new for \$24.00 (as of Nov. 21, 2022) but used and cheaper copies are available from other booksellers. The book is also available at the bookstore in Stamp Union.
- Selected chapters will be assigned and available from ELMS:
 - Foottit, R.G., and P.J. Adler. 2009. Insect Biodiversity – Science and Society. Wiley- Blackwell, UK. 632 pp. ISBN: 978-1-4051-5142-9
- Original research articles, videos, and reviews will be provided as pdf files or as online links.



Nymph (right) and adult (left) of *Ephemerella inconstans* (Ephemeroptera: Ephemerellidae). This is a common species in small streams in Maryland.



Grades

All assessment scores will be posted on the course ELMS page. If you would like to review any of your grades (including the exams), or have questions about how something was scored, please email me to schedule a time for us to meet and discuss.

Late work will not be accepted for course credit so please plan to have it submitted well before the scheduled deadline. I am happy to discuss any of your grades with you, and if I have made a mistake I will immediately correct it. Any formal grade disputes must be submitted in writing and within one week of receiving the grade.

Final letter grades are assigned based on the percentage of total assessment points earned. To be fair to everyone I have to establish clear standards and apply them consistently, so please understand that being close to a cutoff is not the same as making the cut ($89.99 \neq 90.00$). It would be unethical to make exceptions for some and not others.

Final Grade Cutoffs							
+	97.00%	+	87.00%	+	77.00%	+	67.00%
A	92.00%	B	82.00%	C	72.00%	D	62.00%
F	<60.0%						
-	90.00%	-	80.00%	-	70.00%	-	60.00%

Source (see description below)	Points	Percentage	Week of activity
Lecture:	350		
1. Student questionnaire	10	1.8%	1
2. Analysis of New York Times article, "The Insect Apocalypse is Here"	20	3.6%	1
3. Analysis of articles, 5@10 pts	50	8.3%	2,8,9,10,11
4. Science writing exercise	50	8.3%	12
5. POGIL discussions, 5@10 pts	50	18.3%	1,3,5,11,13
6. Portraits of an insect and its ecosystem service	50	8.3%	6
7. Midterm questions	50	8.3%	7
8. Lecture participation	20	3.6%	
9. Final questions	50	8.3%	
Lab:	250		
10. Insect diversity and identification lab sessions, 2@25pts	50	8.3%	4,5
11. Lab experiment reports, 3@40pts	120	20%	
12. Lab quizzes, 12@5 pts	60	10%	
13. Lab participation	20	3.3%	
TOTAL	600	100.00	

Major Assignments

- 1. Student questionnaire, 10 pts.** The questionnaire is a survey of student background on insect biology given on the first day of classes. If completed, the student is given 10 pts.
- 2. Review of New York Times article, “The Insect Apocalypse is Here”, 20 pts.** A set of questions will be provided for the article. Answers must be less than 2 pages in length.
- 3. Analysis of articles, 5 weeks x 10 pts= 50 pts.** A set of questions will be provided for 5 scientific journal articles. Answers must be less than 2 pages in length, including the questions.
- 4. Science writing exercise, 50 pts.** After completing the 5 analyses of research articles, each student will select one article to write up as a short article for popular press. Consisting of a catchy title and no more than 250 words, the article should communicate the approach and discoveries of the scientific research. The student’s article will then be shared with three other students in the class, and their comments will be used to improve the article. The final article is evaluated by the instructor and TAs, and the best ones will be published on the class ELMS site for all.
- 5. POGIL discussions, 5 weeks x 10 pts=50 pts.** POGIL (process-oriented guided-inquiry learning) is a structured method of increasing student involvement in class and engaging students in learning. The class will be assigned into groups of 3 or 4 students, with each student performing a specific role: manager, presenter, recorder, and reflector. These roles will be explained in class. During the period, each group will be given a topic and set of questions, work collaboratively on the answers, and prepare written answers. Discussion across groups will also occur to help with clarification of the topic. There is no work done on the topic beforehand, and answers are due by the end of class. If a student misses class that day, then he/she must review the topic and questions (which will be posted on ELMS after class), and submit the answers by the next class period. Grades will be given equally within each group based on the written answers, and will be evaluated for both content and readability.
- 6. Portrait of an insect: The Good, The Bad and The Weird, 50 pts.** Students will select a species of insect fitting one of the six categories of ecosystem services (economic value, ecological life support, cultural value, recreational value, scientific value, or negative value) for written and oral presentation. A one-page color portrait is prepared, with notes and references on the back side. The insect should be described as “good”, “bad”, or “weird”, and describe its biology, ecology, and especially its functional role within the category of ecosystem services. The portrait will consist of a fact sheet that describes or illustrates its life stages, its distribution, its biology/ecology, and its value to ecosystems as well as to humans. The fact sheet should begin with introductory text stating why the species is good, bad, or weird. References should be listed on the back. Short oral presentations will be given in class. There will be a sign-up sheet to prevent overlap between student pairs.

7. **Questions on insect life and global ecosystems, 50 pts.** At the midterm point, a set of questions covering material in the first two sections of the course will be provided in class. Students can use notes to answer the questions.
8. **Lecture participation, 40 pts.** Given the interactive style of this class, attendance will be crucial to note-taking and thus your performance in this class. Attendance is particularly important also because class discussion will be a critical component for your learning. Each student is expected to make substantive contributions to the learning experience, and attendance is expected for every session. Students with a legitimate reason to miss a live session should communicate in advance with the instructor, except in the case of an emergency. Students who miss a live session are responsible for learning what they miss from that session. Additionally, students must complete all readings and assignments in a timely manner in order to fully participate in class.
9. **Questions on insect biodiversity and the future, 50 pts.** As a final assignment, “take home” questions will be provided on ELMS for written answers covering topics discussed during the semester, due online during finals week.
10. **Insect diversity and identification lab sessions, 50 pts.** Two lab exercises, early in the semester, will aid in learning about the evolution and diversity of insects. A table will be provided for student pairs to complete based on specimens observed from the teaching collection. After identifying specimens using your field guide, the remainder of the table can be completed by internet searches. The table and answers will be due a week following the lab.
11. **Lab experiment reports, 3 x 30 pts = 90 pts.** Three semester-long experiments related to ecosystem services will be conducted by students. First, a cowpea seed beetle which is a stored product pest, will be tested to determine their potential damage to black-eyed peas. Second, leaf decomposition by aquatic invertebrates will be tested in an agricultural stream. Third, three first-order streams will be evaluated for biotic index and functional diversity, to be compared over years. Each will be explained in the context of the scientific method, and results will be discussed near the end of the course. Students will work in pairs for this report.
12. **Lab quizzes, 12 weeks x 5 pts = 60 pts.** At the end of each lab, each student will complete a short quiz over the day’s activities.
13. **Lab participation, 20 pts.** See “7. Lecture participation” above for expectations.



Pipevine swallowtail caterpillar
(Lepidoptera: Papilionidae)



European corn borer larva in
cornstalk (Lepidoptera: Crambidae)



Damsel bug (Hemiptera:
Nabidae) feeding on a
caterpillar

Course Policies

Attendance

Attendance for all lectures and laboratories is required. Each unexcused absence will result in an automatic 5% reduction in your total score. It is your responsibility to contact Dr. Lamp in a timely way for any absence:

- If you expect to miss class because of a religious holiday, a special travel event, or other reason, send Dr. Lamp an email (lamp@umd.edu) beforehand providing the reason, the dates you will be absent, and include the statement, “I acknowledge that the information in this note is accurate.” You are required to make up any information that you miss. Every effort should be made to turn in due assignments before you miss class.
- If you missed class because of a medical issue or some unforeseen event, send Dr. Lamp an email (lamp@umd.edu) as soon as possible providing the reason, the dates you were absent, and include the statement, “I acknowledge that the information in this note is accurate.” You are required to make up any information that you miss. You should turn in due assignments at the next class period.
- Check with Dr. Lamp for specific information and activities you may miss.

Additional information on the University of Maryland policy on medically-necessitated absence from class as well as a wide range of course-related policies can be found at:

<http://www.ugst.umd.edu/courserelatedpolicies.html>

Code of Academic Integrity

The University of Maryland, College Park has a nationally Recognized Code of Academic Integrity, administered by the Student Honor Council. This Code sets standards for academic integrity at Maryland for all undergraduate and graduate students. As a student you are responsible for upholding these standards for this course. It is very important for you to be aware of the consequences of cheating, fabrication, falsification, and plagiarism.

University Policies for Undergraduate Studies

Policies relevant to Undergraduate Courses, including attendance and academic integrity, are found here: <http://ugst.umd.edu/courserelatedpolicies.html>

Topics that are addressed in these various policies include academic integrity, student and instructor conduct, accessibility and accommodations, attendance and excused absences, grades and appeals, copyright and intellectual property.

Course Procedures

Course procedures and policies will be discussed on the first day of classes. Additionally, new procedures and policies may need to be revised or developed after the start of the semester. It is the student’s responsibility to stay informed on procedures and policies.



Walkingstick (Phasmodea: Phasmatidae)

Course Outline (1/18/2023, Subject to change)

	Week	Topic	Activities	Assignments ¹
I. Insect Biodiversity and the Insect Decline	1 25-27 Jan	Insect biodiversity: Result of evolution of life on Earth	W: Course themes, structure and process Lab: Entomology 101 F: Insect evolution and radiation	<ul style="list-style-type: none"> Questionnaire, due by 5:00 of the first day of class Review of the New York Times article, “The Insect Apocalypse is Here”
	2 30 Jan- 3 Feb	Science is a verb	M: Discussion of NY Times article W: Science and ecology/ hypothesis development and discussion Lab: Insect community of a headwater stream - Collection F: POGIL 1: Science and discovery	<ul style="list-style-type: none"> Article analysis 1: Hallman et al. (2017) research article
II. Ecosystems, structure and function, and insect biology	3 6-10 Feb	Geology and climate: Templates for ecosystems	M: Life on Earth, ecosystem structure and function, examples of insects around the world W: The GOOD - Ecosystem services provided by insects Lab: Insect community of a headwater stream – Identification and DNA barcoding F: POGIL 2: Resilience of ecosystems	<ul style="list-style-type: none"> Read Chap 2 from Footitt & Adler (2009)
	4 13-17 Feb	Diversity of form and function in insects	M: Insect form and function, variation of the basic plan, life history of insects, adaptations W: Examples of hemimetabolous orders Lab: Insect diversity I: Hemimetabolous orders F: Examples of holometabolous orders	<ul style="list-style-type: none"> Lab: Insect diversity I identifications and biologies
	5 20-24 Feb	Species adapt to habitats	M: Evolution of insects W: Adaptation and ecological fitting Lab: Insect diversity II: Holometabolous orders F: POGIL 3: Morphological and functional adaptations	<ul style="list-style-type: none"> Lab: Insect diversity II identifications and biologies
	6 27 Feb- 3 Mar	Portraits of the good, the bad and the weird	M: The BAD: Responding with Integrated Pest Management W: Student presentations: Portraits of insect species and their ecosystem services Lab: Exp. 2: Decomposition of leaves in flowing water. F: Student presentations: Portraits of insect species and their ecosystem services	<ul style="list-style-type: none"> Read Chap 9 from Footitt & Adler (2009)
	7 6-10 Mar	Midterm evaluation	M: Review W: Midterm – in class Lab: Exp. 3: Macroinvertebrates in streams – functional roles and indicators of pollution F: In-class discussion on the insect decline and the value of insects	<ul style="list-style-type: none"> Midterm: Insect life and global ecosystems: questions on Sections I and II
	Week	Topic	Activities	Assignments

¹ Assignments are due the following Monday night by midnight, unless otherwise noted.

III. Factors associated with insect decline	8 13-17 Mar	Insect apocalypse: What is the evidence?	M: The insect decline: current review W: Review of original research Lab: Sample processing, Exps. 1-3 F: Discussion of original research	<ul style="list-style-type: none"> Article analysis 2: Review article on insect decline
	20-24 Mar	Spring Break!		
	9 27-31 Mar	Causes and patterns: Climate change	M: Climate change as a factor W: Adaptation and mitigation Lab (W/Th): Sample processing, Exps. 1-3 F:	<ul style="list-style-type: none"> Article analysis 3: Climate change research article
	10 3-7 Apr	Causes and patterns: Land use	M: Agriculture intensification and pesticides as a factor W: Urbanization Lab: Sample processing, Exps. 1-3 F: Mining	<ul style="list-style-type: none"> Article analysis 4: Light pollution research article
	11 10-14 Apr	Causes and patterns: Pollution	M: Pollution as a factor W: Pesticides Lab: Campus field trip – Insect behavior and ecosystem services F: POGIL 4: Chemicals and risk assessment	<ul style="list-style-type: none"> Article analysis 5: Pesticides research article
IV. Society's response to insect decline	12 17-21 Apr	Sustainability, society and science	M: Sustainability: The role of biodiversity W: Balance of nature? Lab: Analysis and discussion, Exps. 1-3 F: Guest speaker	<ul style="list-style-type: none"> Science writing exercise
	13 24-28 Apr	Can we save species?	M: To preserve species: Conservation biology W: Field trip Lab: Field trip – Middle Patuxent River F: POGIL 5: Value of a species	
	14 1-5 May	Can we fix our planet?	M: To renew lost ecosystems: Restoration ecology W: Guest speaker Lab: Lessons from lab and field F: Conclusions for a shared future with insects	
	15 8-10 May	Start of summer: Lightning beetles, dragons, and butterflies	M: A return to the New York Times and final thoughts W: Course evaluation and final thoughts	<ul style="list-style-type: none"> Final: Questions on insect biodiversity and the future



American burying beetle



Karner blue butterfly



Western glacier stonefly