

ENTM 735 “Sustainability”

Summer, 2021

Course Instructor

Dr. William Lamp

www.elms.umd.edu faculty information tab

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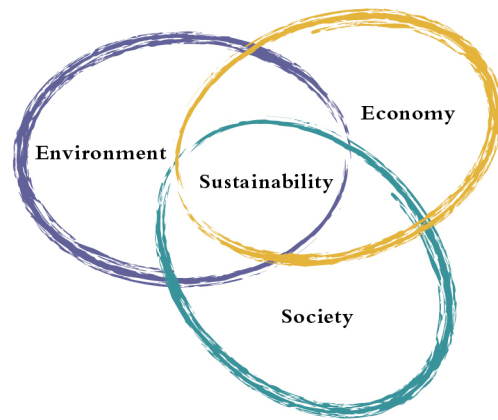


Course Description

Sustainability requires integration of environmental, economic, and sociological factors towards a common goal of durability. Beneficial insects play important roles for sustainable conditions in their contribution to ecosystem services. In addition, injurious insects must be managed appropriately for the health and well-being of mankind. This course will apply the concept of sustainability to both ecosystem services provided by beneficial insects, as well as to the management of injurious insects.

Ecological functions of insects in natural and managed landscapes will be illustrated and discussed. In addition, case histories and discussions will focus on themes of sustainability in successful IPM

programs, as well as specific practices that lead to sustainable practices. In the context of current surprising findings of the decline of insect species and populations, the course will conclude with a discussion of sustainable approaches for conserving and restoring insects in the landscape.



*This image of spotted lanternfly, *Lycorma delicatula*, a new invasive pest of grapes in Pennsylvania, represents one of the forces acting against sustainability for IPM. It is now*

established in Maryland. Once an IPM program for grapes is established, the introduction of a new invasive pest threatens to disrupt biological controls that are in place. In addition, the lanternfly is beneficial because it reduces the growth of tree of heaven, an invasive tree in some locations. How do we manage spotted lanternfly in a sustainable manner?

Educational Objectives

1. Develop an understanding of the concept of sustainability in relation to the life of insects.
2. Become familiar with the diverse roles of insects in the functioning of ecosystems.
3. Identify insect management practices that lead to sustainability.
4. Learn to apply new knowledge derived from original research articles relating to sustainable pest management and insect conservation.
5. Apply the scientific method to development of new knowledge to address sustainability in the field of entomology.
6. Develop skills for communicating sustainability in extension and research settings.
7. Understand the reality of sustainability in relation to the decline of insects in response to global and local issues.

Recommended Textbook

National Research Council. 1996. Ecologically Based Pest Management: New Solutions for a New Century. National Academies Press. 160 pp. ISBN: 0-309051985-3. (available on course website)

An insect identification field handbook. I prefer the following:

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.

Other readings will be provided as pdf files or links to online information.

The larva of the predaceous diving beetle, Agabus disintegratus, was the subject of one of my student's theses. Living in shallow, temporary pools of water on the Eastern Shore, it is a voracious feeder of mosquito larvae, and with other insect predators, helps to keep mosquitoes from breeding in those waters. As a consequence, the beetle provides a valuable ecosystem service to us by suppressing mosquito populations.



Web-based Information

<http://elms.umd.edu>

Use of the Enterprise Learning Management System or Canvas is mandatory for students in ENTM 735 as discussion material as well as lecture material will be found on the website. Everyone who has a University ID and password has a Canvas account. Other instructions can be found on the entry page. Please contact OIT with problems logging on to Canvas: Elms-help@umd.edu

Weekly Modules and Evaluation

The course will be taught in weekly modules, generally ending each Sunday evening^{1,2}. Modules are combined into course sections by topic. After the one-week “Introduction” module, the course will have three sections: “Biodiversity and Ecosystem Services”, “Sustainable Pest Management”, and “Challenges and Prospects for Sustainability”. The course will end with a “Conclusions” module.

To start the week or module, I will schedule a live office half-hour on Zoom to discuss the course, answer any questions, and otherwise engage in conversation. Then, watch my weekly Panopto video of a lecture of the topic for the week, material to review for discussions, and tasks to be completed. Readings, videos, and links to internet information will be provided in the Resources page within each weekly module.

Assignments are listed on the schedule, and below under “Grade Determination”, with details posted as an assignment within each module. For most modules there will be a discussion question to be answered by each student, with each student providing feedback on those answers. Six original research articles are assigned for your review. Three projects will be assigned in concert with each section. The course ends with a set of questions based on the topics covered.



Jon Bansen's Double J Jerseys, an organic farm in the Willamette Valley, Oregon, illustrates the use of IPM for fly management without insecticides. Note the manual use of a fly suction from cows' heads as they pass through to the pasture. In addition, he removes cow feces that serve as breeding sites for the flies, and uses birdhouses to attract tree swallows that eat the adults.

¹ The Independence Day holiday falls on Sunday this year, and the University is closed on Monday, July 5. I will give flexibility during this time with a reduced assignment load, and for variable due dates for assignments.

² The last week overlaps Week 11, and the final assignment is due on Wednesday, August 18, to conclude the course.

I may alter the course schedule and experiences when deemed necessary for the accomplishment of the course objectives. With notification, I reserve the right to alter this syllabus to best meet the needs of the students in the class.

I recognize that teaching a course in the summer, especially an online course, may lead to special circumstances affecting student's abilities to complete their work. Examples include family trips and reunions, field activities associated with a job, etc. Please contact Dr. Lamp if a situation arises such that time is needed to make up for lost time. Nevertheless, you remain responsible for all work, although note that you are only responsible for 7 of the 10 posted discussions, and 4 of the posted article reviews.

Teaching Philosophy and Your Engagement

I believe the best way to learn is through engagement with the subject. Learning is active: to learn is to engage your mind with the subject at hand. I find online courses especially difficult for me to directly involve students in the learning process. In a classroom, I engage students with questions, group discussions, invited speakers, etc. These elements are not available to online classes. Here is what I suggest to each of you:

1. I love insects and enjoy hearing stories and seeing pictures of insects. We will have a place on our website for you to share your insect discoveries with me. This will help me to learn something about each of you, and to share a bit of my knowledge with you as well.
2. Stay organized from week to week. By now, you all are highly qualified students, but especially in summer, life can add an element of chaos to studying. Take a few minutes each week to stay organized.
3. Take notes. In this electronic age, note-taking has become optional. I believe minds are helped by writing. Keep a pad of paper or spiral notebook by your side as you listen to lectures, view videos, or read papers. Take notes of anything that seems important – things that you may want to reflect on later, or use in an assignment, or themes that are likely to be repeated later.
4. Worry less about grades and more about thinking. If you do the work, your grade will be fine. Learning about sustainability and insects requires more than doing the work – reflect and evaluate each activity. At the end of each week, spend a few minutes to reflect on what you have learned during the week. Find a quiet place and time, get a refreshment of choice, and reflect. Review the notes that you took. Jot down your thoughts to help summarize the week in your mind.



Honor Code

The Code of Academic Integrity of the University of Maryland will be enforced in this course. Any student found breaking any aspect of this code will be reported to the Honor Council. The Honor Council will have the option of expulsion for any breach of the code.

Acts of dishonesty include:

- **Cheating:** Intentionally using or attempting to use unauthorized materials, information or study aids in any academic exercise.
- **Fabrication:** Intentional and unauthorized falsification or invention of any information or citation in an academic exercise.
- **Facilitating Academic Dishonesty:** Intentionally or knowingly helping or attempting to help another to commit an act of academic dishonesty.
- **Plagiarism:** Intentionally or knowingly representing the words or ideas of another as one's own in any academic exercise.

Responsibilities and Expectations

Students and instructors benefit from your active involvement in all discussion activities. Therefore, participation is required for class discussions and a major portion of your grade is based on your individual, meaningful contributions.

Professionalism

Students are expected to demonstrate professionalism at all times. This will be assessed during all interactions within the on-line forum. Should issues of concern arise, they will be addressed by the instructor to enhance your educational development. Significant issues may be referred to the student's advisor and/or the academic standing committee.

Student Information Sheet

In order to get to know each of you, I am requesting that you complete a brief survey during the first week of class. The survey is available as a no-point assignment on the module for Week 1. Click on the assignment, download the Word file, complete the form, and convert the file to a PDF to submit it as an assignment.

This graph has been reproduced many times from Hallman et al. (2017) to illustrate the surprising 75% decline over 27 years in total flying insect biomass in protected areas of Germany. We have known that species extinctions are occurring at a greater rate than any time before in Earth's history, but the rate of insect population decline had rarely been documented. We are now concerned about the global loss of ecosystem services provided by insects

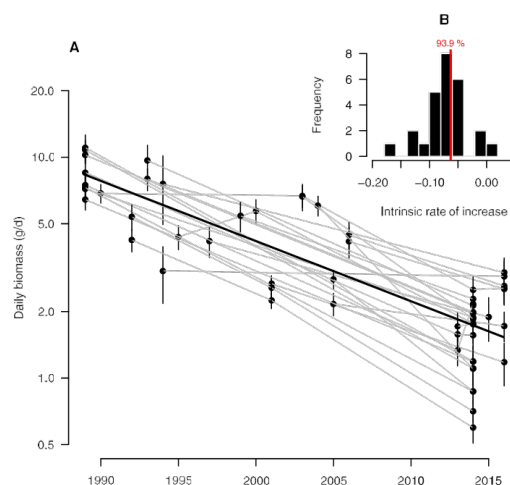


Fig 4. Temporal distribution of insect biomass at selected locations. (A) Daily biomass (mean ± 1 se) across 26 locations sampled in multiple years (see S4 Fig for seasonal distributions). (B) Distribution of mean annual rate of decline as estimated based on plot specific log-linear models (annual trend coefficient = -0.053 , $sd = 0.002$, i.e. 5.2% annual decline).

Grade Determination (Note: See “Module Schedule” to determine what is due and when. Late submissions lose 10% of the points for each day late, but contact me if issues arise.)

1. Weekly Participation in Discussions, 7 at 10 points each. Total = 70 points, 18% of grade.

- a. An essay-type question will be provided for discussion most weeks. Of the 10 posted discussion assignments, please complete 7 of them. Questions will be based on the lecture, readings assigned, and information you may have acquired on your own. Your first response to the question is blind to other posts. Cite sources when appropriate – sources are not required, but use citations if you use a source in your answer. After you post your answer, then you will see other student posts. At least one response to other students’ answers is expected. Grading will be based on engagement with the topic, the effort you put forward, and your unique contribution to the discussion.

2. Primary Literature Reviews, 4 at 20 points each. Total = 80 points, 20% of grade.

- a. Over 6 different weeks, a research article related to insects and sustainability will be assigned for reading. A set of questions will be provided for you to answer with regard to a review of the article. Grading is based on your understanding of the questions as well as the answers. Since there are 6 reviews posted, I will drop the lowest score to select 4 for your point total. Or, you have the option to not answer two of the review question sets.

3. Student Projects, 3 at 50 points each. Total = 150 points, 38% of grade. (Note: written details of the requirements of each project will be provided in the assignment.)

- a. Biodiversity and Ecosystem Services:
 - i. A blog post on a walk in the woods, or other natural area. The project will require a walk in nature, making observations and identifying insects that are participating in the ecosystem. What are the ecological roles of the insects you observe? Are they providing an ecosystem service of benefit to humans? How does this relate to sustainability? (due Sunday evening, June 20)
- b. Sustainable Pest Management:
 - i. Extension-like powerpoint presentation. The project in this section is a presentation designed for an extension meeting where you are to engage an audience of crop producers on **sustainable pest management**. You should describe current and possible new approaches for insect management in a cropping system that enhances sustainability. You are free to choose any cropping system (e.g., corn, soybeans, apples, alfalfa), and state/country where the crop is grown. Your powerpoint should focus on three species in the system: a key pest, an occasional pest, and a new invasive, exotic pest. Provide sufficient biology/ecology of each pest, suggest current management practices from extension websites/publications, and discuss the sustainability of current approaches for management. End with suggestions for research to develop more sustainable approaches for each species. Cite at least three original research articles for each species related to their biology and management. Also, cite the extension sources used for information. (due Sunday evening, July 18)

c. Challenges and Prospects for Sustainability with Insects

- i. A controversial role-playing exercise in sustainable entomology. Students will be assigned roles in an international or national issue where there are conflicting needs in relation to sustainability. The issue will relate to the management of insects in the landscape. As a group, you will define perspectives, and then will need to provide a compromise approach to solving the issue to the satisfaction of all. (due Sunday evening, Aug. 15)

4. Issues of Insects and Sustainability, 100 points, 25% of grade.

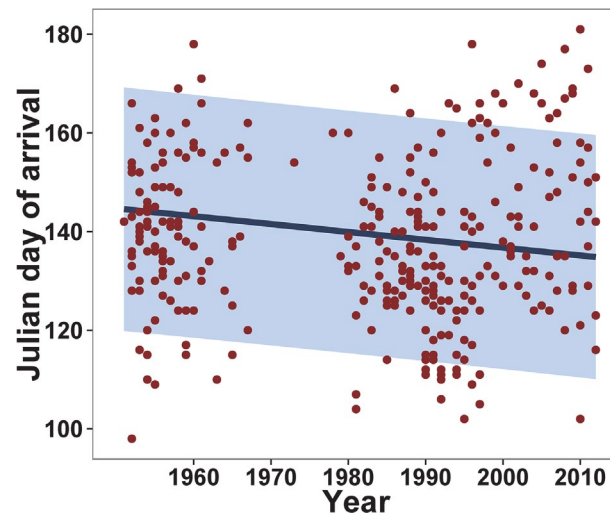
- a. During the last week, you will be given questions to help you to reflect and review on topics of insects and sustainability. It will consist of 10 short essay questions, representing major concepts and topics covered during the course. A copy of last year's questions is available on the course website. Your questions will be very similar and cover many of the same topics. (due Wednesday evening, Aug. 18)

5. Total available = 400 points.

90% and above, 360-400 points	= A
80-89.9%, 320-359 points	= B
70-79.9%, 280-319 points	= C
60-69.9%, 240-279 points	= D
Below 60%	= F

+/- will be assigned when and if necessary

Trends in arrival date (Julian day) of potato leafhopper, Empoasca fabae, in United States during 1951–2012 estimated through LMM. The straight line represents the slope and the extent of shaded region represents lower and upper 95% confidence intervals as estimated by the LMM, and the points represent raw data. Results are consistent with climate change. [from Baker et al. 2015]



Week	Topic	Graded Work ¹
Course Introduction		
1 1-6 Jun	Concept of Sustainability - Introduction to the course and review of topics - Environmental, economic, and sociological factors - Global and local issues	1. Discussion I
Biodiversity and Ecosystem Services		
2 7-13 Jun	The Amazing Roles of Insects in the Global Landscape - Concept of biodiversity - Insects and ecosystem services	1. Discussion II 2. Article Review 1
3 14-20 Jun	Case Histories of Ecosystem Services - Trophic interactions - Decomposition - Pollination	1. Discussion III 2. Blog Post: "Walk in the Woods"
Sustainable Pest Management		
4 21-27 Jun	Integrated Pest Management (IPM): Is it Synonymous with Sustainability? - Definitions - Approaches - Principles	1. Discussion IV 2. Article Review 2
5 28 Jun – Jul 4	Agroecosystem Management to Achieve Greater Sustainability - Agricultural settings as ecosystems - Integrated management - Ecological intensification	1. Discussion V (due July 6)
6 5-11 Jul	Using Natural Enemies to Suppress Pests: Is it Sustainable? - Classical, augmentative, conservation biological control	1. No Discussion 2. Article Review 3
7 12-18 Jul	Using Plant Genetics to Prevent Insect-Induced Damage: Is it Sustainable? - Breeding for traits - Genetic engineering	1. Discussion VI 2. Article Review 4 3. Powerpoint: "Guidelines for Sustainable Insect Pest Management"
8 19-25 Jul	Do Pesticides Play a Role in Sustainable Pest Management? - Types of pesticides - Treatment to prevent vs treatment to suppress, EILs	1. Discussion VII
Challenges and Prospects for Sustainability		
9 26 Jul – 1 Aug	Global Issues Affecting Sustainability	1. Discussion VIII 2. Article Review 5
10 2-8 Aug	Invasive Species and Novel Insect-Host Associations	1. Discussion IX 2. Article Review 6
11 9-15 Aug	Restoration of Ecosystems	1. Discussion X 2. Critique: "Challenges and Prospects for Sustainability with Insects"
Course Conclusions		
12 11-18 Aug	Our Vision of Sustainability: Is It Reasonable?	1. No Discussion 2. "Analysis of Insects and Sustainability" due WEDNESDAY, Aug. 18

¹Unless noted otherwise, all graded work is due by 11:59 pm on Sunday at the end of the module week. Late submissions lose 10% of the points for each day late.