

Epidemiology & Data Science

PLP6905

Gainesville section 4H93 (class # 29810) & REC section 4H95 (class # 21351)

Epidem & Data Sci

3 credit hours

Class meetings: MWF Period 5 (11:45 am -12:35 pm US Eastern)

Classroom for students in Gainesville: 2564 Fifield Hall

Course link for students outside Gainesville will be in Zoom:
(Provided to class members)

Class materials will be in Teams

For participants outside UF, outside the US: Note that, in the US, Daylight Saving Time ends Sunday, Nov 3, 2024, so the time zone of the course will change from Greenwich Mean Time minus four (GMT-4) to GMT-5, and the course will effectively be one hour later if your location doesn't change time. For participants in the US Eastern time zone, the course will continue to be 11:45-12:35.)

Prerequisites: General knowledge of agricultural, ecological, or epidemiological systems, at least two undergraduate or graduate courses applying quantitative concepts and tools (such as statistics or quantitative ecology courses)

Instructor: Dr. Karen A. Garrett (garrettlab.com)

Plant Pathology, Global Food Systems Institute, Emerging Pathogens Institute

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Co-Instructors:

Dr. Ashish Adhikari

Dr. Romaric Mouafo-Tchinda

Aaron Plex Sulá

Jacob Robledo

Office hours

By appointment in advance, 12:50-1:40 Monday and Wednesday, or additional times as needed

Course overview

Plant disease epidemiology addresses how interactions among plants, pathogens, vectors, the abiotic environment, and human decision-making result in the occurrence of plant disease and the spread of plant pathogens. Epidemiology also represents the interface between plant pathology and other disciplines, such as meteorology, social sciences, and ecoinformatics.

This course addresses classical approaches to epidemiology as well as frontiers that make use of new big data opportunities and artificial intelligence. One theme of the course in 2024 is rapid risk assessment and mitigation planning for plant diseases. The course provides an introduction to the R programming environment, data science applications in epidemiology and epidemiological analyses using R. The course includes a combination of lectures to provide background information, breakout sessions for small group discussion, computational analysis workshops to illustrate concepts, discussion of current literature, and individual projects to allow participants to apply ideas to systems that particularly interest them.

In the individual projects, each participant will select a disease (or disease complex) of particular interest, assemble a portfolio of epidemiological information related to that disease (or similar diseases, if data are sparse), prepare a short proposal including an experimental design to collect important new data related to the disease, analyze (real or simulated) results from that proposal, and evaluate regional management strategies for the disease in an epidemiological synthesis.

The course emphasizes concepts and use of existing tools, while at the same time it will offer a basis for the development of new epidemiological tools for participants interested in further steps.

Course learning objectives

Participants who have completed this course will be able to...

- ❖ explain and apply general epidemiological concepts, such as disease progress over time, pathogen dispersal, sampling strategies, and spatial analyses
- ❖ broadly understand and discuss journal articles addressing plant disease epidemiology
- ❖ design basic epidemiological studies, in designed experiments and observational studies
- ❖ apply epidemiological concepts to the design of disease management across scales
- ❖ broadly understand and discuss applications of artificial intelligence in plant disease management
- ❖ analyze basic epidemiological studies using R

Course outline (as of August 23, 2024 – subject to minor changes)

Graded assignments are indicated in the schedule in bold.

Week of	Monday	Wednesday	Friday
Aug 23			Intro to epidemiology and this course
Aug 26, 28, 30	Individual introductions, intro to data analysis	Intro to R programming environment I – (Ashish, Plex, Jacob)	Disease progress over time I – (Romaric)
Sept 2, 4, 6	LABOR DAY	Intro to R programming environment II (Quiz) – (Ashish, Plex, Jacob)	Disease progress over time II, with examples in R – (Romaric)
Sept 9, 11, 13	Disease progress over time III, with examples in R (Quiz)	Pathogen dispersal I	Discussion of project proposal development
Sept 16, 18, 20	Pathogen dispersal II, with examples in R (Quiz)	Sampling epidemiological processes I	Sampling strategies, examples in R (Quiz)
Sept 23, 25, 27	Epidemic networks I	Epidemic networks II, with examples in R (Quiz)	Reproducible epidemiological research
Sept 30, Oct 2, 4	Weather, climate, and disease risk analysis I (Plex) [Project proposal videos (first drafts) due, not graded]	Weather, climate, and disease risk analysis II, with examples in R (Plex) (Quiz)	Breakout groups discuss project proposal videos (first drafts)
Oct 7, 9, 11	Ecoinformatics, integrating GIS and spatial analyses, with examples in R (Plex)	Epidemiological perspectives on microbiomes (Quiz) – (Ashish)	Project proposal presentations
Oct 14, 16, 18	Ecoinformatics in epidemiology	Integrating molecular tools in epidemiology (Quiz)	HOMECOMING

Oct 21, 23, 25	Integrating socioeconomics in epidemiology and decision support tools	Artificial intelligence and big data in epidemiology	Machine learning in epidemiology, with examples in R (Quiz) – (Jacob)
Oct 28, 30 Nov 1	Epidemiology in digital agriculture	Decision support systems for disease management	Scientific paper discussion
Nov 4, 6, 8	The value of information (VOI) and research priorities	Continental epidemics	Scientific paper discussion
Nov 11, 13, 15	VETERANS DAY	Image analysis to inform epidemiology	Scientific paper discussion
Nov 18, 20, 22	Epidemics in seed systems	Disaster plant pathology	Participant choice topic
Nov 25, 27, 29	Participant choice topic	--- Thanksgiving vacation, no classes	--- Thanksgiving vacation, no classes
Dec 2, 4	Review and synthesis of course topics, and epidemiology frontiers	--- No synchronous meeting of the class - instead, individual meetings scheduled near this day ---	---- READING DAYS --
Finals week	Final exams week: Final presentations		

Grading

Graduate students (PLP6905)

20% Class discussions

20% Quizzes

20% Project proposal

10% Journal article presentation and discussion

30% Final project

Short quizzes over the previous days' topics are given most weeks, for a total of 11 quizzes, to help participants keep up with the course material. The lowest 3 quiz scores will be dropped from the grade, so there is no option to make up quizzes.

The project proposal will give students an opportunity to show how they can apply the course concepts and tools to a disease of particular interest to them.

Each participant in PLP6905 (graduate students) will lead or co-lead a journal article discussion for the group, and other graduate student participants will be expected to contribute to the discussion.

Final projects will be presented and discussed in the class during finals week.

If the grade on an assignment appears incorrect, the process for requesting reconsideration of the grade is to prepare a written statement describing where the error lies, to be turned into the instructor within three days of receiving the grade.

Grades and Grade Points: For information on current UF policies for assigning grade points, see

<https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx>

Grading scale: 94-100 A; 90-93 A-; 87-89 B+; 84-86 B; 80-83 B-; 77-79 C+; 74-76 C; 70-73 C-; 67-69 D+; 64-66 D; 60-63 D-

Required course materials

There is no required textbook for this course. Review articles and journal articles for discussion will be provided to the class. The journal articles for which participants will lead discussions will be chosen in discussion with the participants, to represent the general topics in the schedule above.

Good general references for plant disease epidemiology include:

Madden, Hughes, & van den Bosch. 2007. The Study of Plant Disease Epidemics. APS Press.

Cooke, Jones, & Kaye, eds. 2006. The Epidemiology of Plant Diseases. Springer

Del Ponte. 2023. R for Plant Disease Epidemiology. <https://r4pde.net/>

A good reference for data science in R is the following:

Wickham & Golemund. 2017. R for Data Science, 2nd Edition. O'Reilly.
<https://r4ds.hadley.nz/>

A good general reference for R (though getting a little out of date):

Crawley. 2012. The R Book. Wiley.

A set of useful “cheat sheets” for R:

<https://www.rstudio.com/resources/cheatsheets/>

This is a series of modules we developed with examples of the use of R in plant disease ecology and epidemiology, available through the following link. This has acquired some typos through movement from one platform to another over the years, so we'll provide a few corrections in class

<https://www.apsnet.org/edcenter/disimpactmngmnt/topc/EcologyAndEpidemiologyInR/Pages/default.aspx>

Garrett's teaching philosophy

I think of teaching as a process that occurs in a network of people. An individual could create a pretty good learning experience by finding a good set of books and papers on a topic, and trying out some R code on their own. However, this course is designed to offer a fuller experience and more efficient learning by linking participants to key literature, to relevant R packages, and to each other and the instructors through discussions and feedback. Engaging with a group of people interested in a topic can also be a lot of fun and boost creativity.

The course is designed to support participants in engaging with projects, rather than emphasizing testing. The quizzes are intended to provide some structure to help keep people up to date and engaged in the discussions. Most of the course activities will engage knowledge and creativity in developing projects. I will work to help each student develop a project relevant to their current and/or future research.

Attendance and make-up policies

This is a synchronous course, to make the most of interactions among participants. Discussion among course participants is an important part of the learning experience, so attendance is required. Three course meetings can be missed without explanation (with the exception of dates when the participant has a particular responsibility, such as leading discussions or presenting). Please alert the instructor if there is a serious health problem or other emergency.

Requirements for class attendance and make-up exams, assignments and other work are consistent with university policies that can be found at:
<https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx>.

Recorded class sessions

Our class sessions may be audio visually recorded for students in the class to refer back and for enrolled students who are unable to attend live. Students who participate with their camera engaged or utilize a profile image are agreeing to have their video or image recorded. If you are unwilling to consent to have your profile or video image recorded, be sure to keep your camera off and do not use a profile image. Likewise, students who un-mute during class and participate orally are agreeing to have their voices recorded. If you are not willing to consent to have your voice recorded during

class, you will need to keep your mute button activated and communicate exclusively using the "chat" feature, which allows students to type questions and comments live. The chat will not be recorded or shared. As in all courses, unauthorized recording and unauthorized sharing of recorded materials is prohibited.

Accommodations for Students with Disabilities

The Disability Resource Center coordinates the needed accommodations of students with disabilities. This includes registering disabilities, recommending academic accommodations within the classroom, accessing special adaptive computer equipment, providing interpretation services and mediating faculty-student disability related issues. Students should first register with the Disability Resource Center at 0001 Reid Hall, 352-392-8565, www.dso.ufl.edu/drc/ and provide appropriate documentation.

On-line course evaluation

For this course, we will also ask students to anonymously provide some more specific recommendations for making the course as useful and interesting as possible, in both a mid-term survey and a final survey. This will be in addition to the general UF course assessment.

UF Policy: Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at <https://gatorevals.aa.ufl.edu/students/>. Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via <https://ufl.bluera.com/ufl/>. Summaries of course evaluation results are available to students at <https://gatorevals.aa.ufl.edu/public-results/>

Materials and supplies fees

None

UF Policy on Academic Honesty

As a student at the University of Florida, you have committed yourself to uphold the Honor Code, which includes the following pledge: "We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honesty and integrity." You are expected to exhibit behavior consistent with this commitment to the UF academic community, and on all work submitted for credit at the University of Florida, the following pledge is either required or implied: "On my honor, I have neither given nor received unauthorized aid in doing this assignment." It is assumed that you will complete all work independently in each course unless the instructor provides explicit permission for you to collaborate on course tasks (e.g. assignments, papers, quizzes, exams). Furthermore, as part of your obligation to uphold

the Honor Code, you should report any condition that facilitates academic misconduct to appropriate personnel. It is your individual responsibility to know and comply with all university policies and procedures regarding academic integrity and the Student Honor Code. Violations of the Honor Code at the University of Florida will not be tolerated. Violations will be reported to the Dean of Students Office for consideration of disciplinary action. For more information regarding the Student Honor Code, please see: <https://policy.ufl.edu/regulation/4-040/>

UF Policy on Software Use

All faculty, staff and students of the university are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against university policies and rules, disciplinary action will be taken as appropriate.

Campus helping resources

The university's counseling resources are available for students experiencing personal problems that interfere with their general well-being and/or academic performance. The Counseling & Wellness Center provides confidential counseling services at no cost for students that are currently enrolled with the university.

- University Counseling & Wellness Center, 3190 Radio Road, 352-392-1575, www.counseling.ufl.edu/cwc/
 - Counseling Services
 - Groups and Workshops
 - Outreach and Consultation
 - Self-Help Library
 - Training Programs
 - Community Provider Database

- Career Resource Center, First Floor JWRU, 352-392-1601, www.crc.ufl.edu/

Student complaints

If there is an issue in the course, please bring it to the instructor's attention. UF policies about more serious complaints are described in these documents.

- Residential Course: https://www.dso.ufl.edu/documents/UF_Complaints_policy.pdf
- Online Course: <http://www.distance.ufl.edu/student-complaint-process>