Impact through Networks

PLP6905 Section 27CE

2 credit hours

Class meetings: Tuesday and Thursday, Period 5 (11:45-12:35), 2564 Fifield Hall

Prerequisites

General knowledge of agricultural, ecological, or epidemiological systems, at least two undergraduate or graduate courses applying quantitative concepts and tools

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Course materials access: http://elearning.ufl.edu/

Office hours

By appointment in advance, 2-4 Tuesday and 3-5 Wednesday, or additional times as needed

Course overview

Outcomes in systems such as agriculture, natural ecosystems, and health care are often determined by processes that act through networks. Networks can describe the spread of pathogens, invasive species, consumer goods, ideas, and technologies. Networks can also describe associations, interactions, and transactions among people, species, and other agents. This course addresses how to analyze the impact of system changes in networks, such as the introduction of new species or new management techniques. The course provides an introduction to network science in the R programming environment, and a review of applications in biological and social sciences, including current methods in evaluating impact. The course includes a combination of lectures to provide background information, discussion of current literature, computational analysis workshops to illustrate concepts, and individual projects to allow participants to apply ideas to systems that particularly interest them.

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

Course learning objectives

Participants who have completed this course will be able to…

❖ explain how networks are defined and applied in agriculture, ecology, and epidemiology
❖ explain basic principles of impact analysis in these systems
❖ broadly understand and discuss journal articles describing networks in these systems
❖ evaluate dynamic networks and study processes in networks
❖ collect data for characterizing networks and testing the fit of network models
❖ apply network analysis to ask questions about their own systems using R

Course outline (*as of August 18, 2017 – subject to change*)

	Tues: often a short lecture and discussion of a paper	**Thurs**: often a short lecture and a workshop for network analysis in R	**Teachers**
Aug 22,24	Introduction to course	Examples of what can be done with skills from this class	Garrett
Aug 29, 31	Intro to R	Intro to R	Andersen, Poudel
Sep 5, 7	Networks and adjacency matrices Epidemic networks	Matrices and simple networks in R Describing nodes in R	Garrett
Sep 12, 14	Describing networks Ecological networks	Visualizing and describing networks in R	Andersen, Poudel, Choudhury, and Buddenhagen
Sep 19, 21	Systems biology / 'omics networks Economic networks	Evaluating subgroups in R	Garrett
Sep 26, 28	Mathematical models of networks in R	Networks and systems	Garrett and TBD
Oct 3, 5	Microbiome networks	Networks of association in R	Poudel
Oct 10, 12	*Paper discussion* & Networks and systems	*Paper discussion* & Networks and systems	TBD
Oct 17, 19	**Proposal presentations**	**Proposal presentations**	Garrett
Oct 24, 26	Networks and meta-populations in landscapes	*Paper discussion* & Bayesian networks	Choudhury and Buddenhagen
Oct 31, Nov 2	Multilayer networks	Review of network analysis in R	Garrett
Nov 7, 9	*Paper discussion* &	*Paper discussion* &	Garrett

	Statistical models of networks in R	More statistical models of networks in R	
Nov 14, 16	*Paper discussion* & Modeling processes in networks	Exponential random graph models (ERGMs) in R	Garrett
Nov 21, 23	Complex adaptive systems	*Thanksgiving vacation*	Garrett
Nov 28, 30	Topic: participant choice	Topic: participant choice	Garrett
Dec 5	**Final project presentations**		

Grading

Graduates
20% Class discussions
20% Weekly quizzes and assignments
20% Project proposal
10% Journal article presentation and discussion
30% Final project

Brief quizzes are given most weeks, to help participants keep up with the course material. The lowest three 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 an area of particular interest to them.

Each participant will lead or co-lead a journal article discussion for the group.

Final projects will be presented and discussed in the class.

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 one week 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. Journal articles for discussion will be provided to the class. The journal articles will be chosen in discussion with the participants who will be leading discussions, to represent the general topics in the schedule above.

For network analysis in R, both of the following books are good references. It's recommended that course participants use at least one of these two books as a reference.

1. This one takes more of a statistical perspective, with more careful mathematical definitions and denser information:

Kolaczyk and Csárdi. 2014. Statistical Analysis of Network Data with R. Springer.

2. Luke has a lot of experience in public health applications, and writes more toward non-statisticians:

Luke. 2015. A User's Guide to Network Analysis in R. Springer.

Participants might be interested in the following book for reference, which provides much more information about general network applications than will be covered in this course:

Newman. 2010. Networks: An Introduction. Oxford University Press.

The following is a good reference on social networks, written by UF's own Jeffrey C. Johnson:

Borgatti, Everett, and Johnson. 2013. Analyzing Social Networks. Sage Publications.

A good general reference for R:

Crawley. 2012. The R Book. Wiley.

Garrett's teaching philosophy

I think of teaching as a process that occurs in a network (of course). 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 that they will find useful in their current 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.

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: Student assessment of instruction is an important part of efforts to improve teaching and learning. At the end of the semester, students are expected to provide feedback on the quality of instruction in this course using a standard set of university and college criteria. These evaluations are conducted online at https://evaluations.ufl.edu. Evaluations are typically open for students to complete during the last two or three weeks of the semester; students will be notified of the specific times when they are open. Summary results of these assessments are available to students at https://evaluations.ufl.edu/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: http://www.dso.ufl.edu/sccr/process/student-conduct-honor-code.

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