

Root and Rhizosphere Ecology

(ENR 7580), Fall 2020, 2 credit hours

Time: Mondays 10:05 AM-12:05 PM Place: Kottman Hall 245 and Williams Hall 123A*

**Course can be moved online and completed via Zoom if necessary*



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Course Background and Overview: The rhizosphere mediates plant nutrient acquisition, sustains microbial communities, contributes to disease suppression, and regulates global nutrient cycles, directly impacting crop production and ecosystem services. This course will provide a broad overview of the fundamentals of root and rhizosphere structure and function. Key topics will include root production and turnover, rhizosphere communities, nutrient cycling in both managed and unmanaged ecosystems and rhizosphere responses to global climate change. An emphasis will be placed on methods and techniques used to monitor and measure roots and rhizosphere processes. By the end of the course students will be able to relate rhizosphere dynamics to plant growth, soil health, and ecosystem function.

Course Objectives:

1. Define and describe root and rhizosphere structure and function
2. Relate rhizosphere processes to crop production and ecosystem services
3. Critically evaluate different methods and techniques used to measure rhizosphere processes.
4. Comprehend and communicate the latest research in rhizosphere ecology
5. Develop and expand skills in scientific writing, learn to effectively review and analyze the scientific literature, lead class discussions and present research topics.

Required Course Materials:

1. The majority of readings will be posted on Carmen.

2. The Hidden Half of Nature: The Microbial Roots of Life and Health by David R. Montgomery and Anne Bikle

Class Schedule:

Week	Topic/Lecture
1	Overview of course; Introduction to Rhizosphere Ecology
2	Root structure and function (Root development, nutrient acquisition, water uptake) Book Discussion (pg. 1-130)
3	Root microbiome and soil food web dynamics Book Discussion (pg.131-257)
4	Physical and chemical forces in the rhizosphere Discussion (State of the science #1)
5	Legume-Rhizobia Symbiosis Discussion (State of the science #2)
6	Mycorrhizal Associations (Guest Lecture) Discussion (State of the science #3)
7	Rhizosphere Priming Discussion (State of the science #4)
8	Belowground net primary production, turnover, and nutrient cycling in natural and unmanaged systems Discussion (State of the science #5)
9	Plant biodiversity and belowground niche complementarity Discussion (State of the science #6)
10	Root competition (Intraspecies and interspecies) Discussion (State of the science #7)
11	Root traits and plant + soil health Discussion (State of the science #8)
12	Global climate change impacts on roots and influence on ecosystem function in natural and managed systems Discussion (State of the Science #9)
13	Plant communication with other organisms Discussion (State of the Science #10)
14	Advances in root methodology Discussion (State of the Science #11)

15	Presentations
	Presentations
16	Presentations
	Presentations

Course Assessments:

Class preparation and participation.....	25%
Lead class discussion on scientific articles....	10%
Objectives and term paper outline.....	5%
Annotated bibliography.....	15%
Term research paper.....	30%
Oral presentation on research topic.....	15%

Class preparation and participation:

This is a graduate level seminar course, therefore, active participation from all students is crucial and will enhance the learning experience for all. Recognizing that there are multiple ways to participate and contribute toward class discussions, students will be graded on a variety of different activities that assess class preparedness and participation. Such activities will include a mixture of reading reflections, in-class essays, and participation in class discussions. Due to the number of in-class activities, attendance and punctuality is crucial. Peer review evaluations of final oral projects will also count towards your participation grade.

Lead class discussion on relevant peer-reviewed articles:

One class section a week will be devoted to class discussions, starting in week three. Each student will have the opportunity to lead one class discussion over the course of the semester. The discussion leader is responsible for selecting the required reading materials on a relevant topic in rhizosphere ecology. The leader should treat this discussion as a 'state of the science address', whereby the discussion adequately complements the readings. During the second and third week of the semester, we will read the class 'common book', The Hidden Half of Nature: The Microbial Roots of Life and Health by David R. Montgomery and Anne Bikle and critically relate this popular non-fiction book to the scientific literature. This text is meant to serve as a good introduction to soils, rhizosphere ecology, and microbiology.

Term Paper:

A term paper is required and will be due at the end of the course. The purpose of this term paper is to give each student the opportunity to enhance their understanding of rhizosphere ecology and demonstrate their ability to think critically and synthesize the scientific literature on a given topic. Given that this assignment is a large portion of the total grade, there will be assignments throughout the course that will help with the culmination of this term paper. For instance, an in-class writing activity will be assigned in the first two weeks of class to help identify a topic for the term paper. An outline of the term paper including the

objective/hypothesis will be due in the sixth week. An annotated bibliography will be due in the eighth week to help students start the process of gathering information on their topic of choice and to help start with the initial synthesis of the scientific literature.

Oral Presentations:

The oral presentations will be scientific conference style power-point presentations. Each speaker has 12 minutes present with 3 minutes of questions. This exercise will help students practice public speaking skills in addition to synthesizing and communicating the highlights from their term paper.

Grading: Grades will be based upon the following scale:

A (100-93%); A- (92-90%); B+ (89-87%); B (86-83%); B- (82-80%); C+ (79-77%); C (76-73%); C- (72-70%); D+ (69-67%); D (66-63%); D- (62-60%)

The Ohio State University's Academic Integrity Policy:

Academic integrity is essential to maintaining an environment that fosters excellence in teaching, research, and other educational and scholarly activities. Thus, The Ohio State University and the Committee on Academic Misconduct (COAM) expect that all students have read and understand the University's Code of Student Conduct, and that all students will complete all academic and scholarly assignments with fairness and honesty. Students must recognize that failure to follow the rules and guidelines established in the University's Code of Student Conduct and this syllabus may constitute Academic Misconduct.

The Ohio State University's Code of Student Conduct (Section 3335-23-04) defines academic misconduct as: Any activity that tends to compromise the academic integrity of the University, or subvert the educational process. Examples of academic misconduct include (but are not limited to) plagiarism, collusion (unauthorized collaboration), copying the work of another student, and possession of unauthorized materials during an examination. Ignorance of the University's Code of Student Conduct is never considered an excuse for academic misconduct, so I recommend that you review the Code of Student Conduct and, specifically, the sections dealing with academic misconduct.

If I suspect that a student has committed academic misconduct in this course, I am obligated by University Rules to report my suspicions to the Committee on Academic Misconduct. If COAM determines that you have violated the University's Code of Student Conduct (i.e., committed academic misconduct), the sanctions for the misconduct could include a failing grade in this course and suspension or dismissal from the University.

If you have any questions about the above policy or what constitutes academic misconduct in this course, please contact me.

Disability:

If you would like to request academic accommodations based on the impact of a disability qualified under the Americans with Disabilities Act and Section 504 of the Rehabilitation Act of 1973, contact your instructor privately as soon as possible to discuss your specific needs. Discussions are confidential.

In addition to contacting the instructor, please contact the Student Life Disability Services at 614-292-3307 or ods@osu.edu to register for services and/or to coordinate any accommodations you might need in your courses at The Ohio State University.