HOS 6355 – ROOT AND RHIZOSPHERE ECOLOGY
3 CREDITS – 100% ONLINE

Contact Information
Main Instructor: Dr. Lorenzo Rossi
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Ph.D. Student
UF/IFAS Horticultural Sciences Department
Email: sbenevenute@mail.ufl.edu

Office hours: online conferencing via canvas/zoom (by request)

Lectures: 100% Online course. Each week there is a block of content available with specific due dates.

Contacting the Instructor and the Teaching Assistants:
Questions about class materials or content: Please use the discussion boards in Canvas for all questions about class mechanics or content. If you have a question about the class or subject material, others probably share the same question, and posting it to the discussion boards allows everyone to see the question and answer, just as if you had raised your hand in class and asked the question. If you use email to ask a general class related question, you will be asked to post your question on the appropriate board, and it will be answered there. Please do not use the discussion boards for questions about specific quiz questions on a quiz that is still open, as others may not have taken the quiz yet and would have an unfair advantage by seeing the questions ahead of time.
**Individual questions, problems, or appointments.** Please use the email function in Canvas to communicate with the instructor and the TAs during the semester, rather than regular university email, except in extreme emergencies. Email and phone messages delivered on weekdays (M-F) will generally receive a reply within one business day (24 hours). Messages may not be checked between 5:00 pm Friday and 8:00 am Monday. Messages received over the weekend will generally receive a response on Monday. If I and/or the TAs plan to be out of the office or otherwise unavailable, I will post an announcement on the class website.

**Questions about Grading** This is a large class. We work as a team to manage the various components. The course TAs do the grading on the group project assignments and some of the quizzes. The TAs are graduate students and apprentice instructors. If you have a question or concern about your discussion post grades, please contact the TAs first. If you have an issue that cannot be resolved with your TAs, your course instructor will be happy to work with you both to reach a satisfactory understanding. For questions about exam grades, please contact your main instructor. For questions about course concepts, including quiz questions. Both the instructors and the TAs are ready to help!

**Technical support:** If you experience difficulties with accessing components of the site, including lectures, quizzes, or tests, contact the UF help desk immediately. If they are not able to resolve your problem, contact the instructor with your help desk ticket number and a description of the problem and steps taken to resolve it. Extensions for due dates will be granted for documented technical problems, as needed.

**Course Description:** The aim of this course is to provide a complete view of the rhizosphere and its unique functioning that implies numerous, strong, and complex interactions among plant roots, soil constituents, and microorganisms. The course also focuses on current discoveries and achievements in plant root science and presents and discusses the future challenges that root and rhizosphere research is facing. Topics cover root structure and architecture, function, regulation, and root and rhizosphere response to varying environmental conditions, including interactions among microbes, mycorrhizae, micro fauna, fungi, soil heterogeneity, biogeochemical cycles, biotic and abiotic stresses, and emerging contaminants.

**Knowledge prerequisites:** This is an advanced course which examines the interactions between the plant root system and the environment. To be successful, students should have a general knowledge of biology, botany, microbiology, and soil chemistry.

**LEARNING OBJECTIVES**

After successful completion of this course, students will be able to:

- Recognize key anatomical and morphological features of plant roots.
- Describe main physiological and biochemical responses in the root system.
- Identify the role of plant roots in the global context of soil development and atmosphere composition.
- Classify and recognize root-derived products.
- Compare different root system architectures.
- Describe root responses to biotic and abiotic stresses.
- Explain key root-rhizosphere interactions, from beneficial microorganisms to detrimental nematodes.
- Recommend modern research techniques for field and lab studies on plant roots.
- Locate, appraise, and assimilate evidence from recent scientific studies related to plant root science.

**COURSE MATERIALS**

**Recommended textbooks**


**EVALUATION OF LEARNING**

<table>
<thead>
<tr>
<th>Assignment</th>
<th>% of grade</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) 15 Quizzes due every week</td>
<td>20</td>
<td>600</td>
</tr>
<tr>
<td>2) 6 Discussions due every other week</td>
<td>20</td>
<td>600</td>
</tr>
<tr>
<td>3) Group project</td>
<td>25</td>
<td>750</td>
</tr>
<tr>
<td>4) First Exam</td>
<td>10</td>
<td>300</td>
</tr>
<tr>
<td>5) Mid-Term Exam</td>
<td>10</td>
<td>300</td>
</tr>
<tr>
<td>6) Final Exam</td>
<td>15</td>
<td>450</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100</strong></td>
<td><strong>3000</strong></td>
</tr>
</tbody>
</table>

**Quizzes**

At the end of each module, a specific quiz will assess the student’s learning. Ten questions related to each module will be available. Students will have 2 possible attempts. Points will be available for each question, for a total of 40 points per quiz.

**Group project**

Students will be assigned to a team; each team will work on creating an Extension publication (i.e., EDIS or trade journal magazine paper) during the course. A list of suggested publication topics will be provided. All projects are subject to approval by the instructor and the TAs. The project component will include a short-written outline (due 9/20/2023), a mid-term project publication draft with proposed bibliography (due 10/27/2023), and a final publication with pictures and graphics (due 11/29/2023). Each component adds some significant element to the final grade. The overall project grade will be based on
the quality of each component of your work. The above project components are due to the instructor and the TAs via canvas. Parts 1 and 2 of the group project are worth 200 points each. Part 3 of the group project is worth 350 points.

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Ratings</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Part One – Outline</td>
<td>200 to &gt;100 points Outline is well defined and contains all the necessary information</td>
<td>200 points</td>
</tr>
<tr>
<td></td>
<td>100 to &gt;0 points Outline only has some information but lacks clarity and organization</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0 points Outline not submitted; or all expectations of group project part one not met</td>
<td></td>
</tr>
<tr>
<td>Part Two – Draft and Bibliography</td>
<td>200 to &gt;100 points Draft is well written, and citations and references are appropriately chosen</td>
<td>200 points</td>
</tr>
<tr>
<td></td>
<td>100 to &gt;0 points Draft is hard to read, lacks clarity and contains several errors and/or bibliography is poorly chosen or not submitted</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0 points Draft and bibliography not submitted; or all expectations of group project part two not met</td>
<td></td>
</tr>
<tr>
<td>Part Three – Final Publication</td>
<td>350 to &gt;175 points Publication reads well, is comprehensive and easy to understand; includes relevant graphics, figures and examples.</td>
<td>350 points</td>
</tr>
<tr>
<td></td>
<td>175 to &gt;0 points Publication reads poorly, is not comprehensive and difficult to understand; and/or does not include relevant graphics, figures and examples.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0 points Publication not submitted; or all expectations of group project part three not met</td>
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</table>

**Total Points: 750**

**Discussions**

At the end of every other week, a discussion board with a specific prompt will be ready for the students. Students will not be able to read posts made by other students until after they have already completed and submitted their own post. Each submitted post should consist of 500 words or less and must address all parts of the prompt. Each student will also be expected to post a reply to at least two other students’ posts to receive credit. Poor quality submissions will receive partial credit. The grading procedures of the discussion will follow this rubric:
<table>
<thead>
<tr>
<th>Criteria</th>
<th>Ratings</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Original Response to Prompt</td>
<td>60 to &gt;30 points Responses addresses all parts of the prompt in a convincing and clear manner, and consist of 500 words or less</td>
<td>60 points</td>
</tr>
<tr>
<td></td>
<td>30 to &gt;0 points Response only addresses some parts of the prompt and/or is significantly more than 500 words</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0 points Response not submitted; or all expectations of discussion thread not met</td>
<td></td>
</tr>
<tr>
<td>Reply to Peers</td>
<td>40 to &gt;20 points Student responds to at least 2 peers with substantive comments that further the conversation</td>
<td>40 points</td>
</tr>
<tr>
<td></td>
<td>20 to &gt;0 points Student responds to only 1 peer with substantive comments or responds with 2 comments that lack significance</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0 points Response not submitted; or all expectations of discussion thread not met</td>
<td></td>
</tr>
</tbody>
</table>

**Total Points: 100**

**Exams**

There will be 3 exams in this course. All three exams will have 5 questions. 60 points will be available for each question in Exam 1 (Module 1-5) and Exam 2 (Module 6-10). The first 5 questions of the Final Exam will be related to Module 11-15 questions and 60 points will be available of these questions; but there will be two additional comprehensive questions, for a total of 75 points each. Students will have 7 days to start the exam. Once started, students will have 12 hours to complete it.

**Exams**

<table>
<thead>
<tr>
<th>Exams</th>
<th>Content Covered</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) First Exam</td>
<td>Modules 1-5</td>
</tr>
<tr>
<td>2) Mid-Term Exam</td>
<td>Modules 6-10</td>
</tr>
<tr>
<td>3) Final Exam</td>
<td>Modules 11-15, plus 2 comprehensive questions</td>
</tr>
</tbody>
</table>

**Assignment Breakdown**

<table>
<thead>
<tr>
<th>Assignment</th>
<th>Points × Number of Assignments = Total Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>15 Quizzes</td>
<td>$40 \times 15 = 600$</td>
</tr>
<tr>
<td>6 Discussions (6 prompts, 12 replies)</td>
<td>$100 \times 6 = 600$</td>
</tr>
<tr>
<td>Group project part 1 and 2</td>
<td>$200 \times 2 = 400$</td>
</tr>
<tr>
<td>Group project final part</td>
<td>$350$</td>
</tr>
<tr>
<td>2 Exams</td>
<td>$300 \times 2 = 600$</td>
</tr>
<tr>
<td>1 Final Exam</td>
<td>$450$</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>$3000$</td>
</tr>
</tbody>
</table>
**Critical dates**

- **Group Project Part 1**: 9/20/2023  (Outline)
- **First Exam**: 10/2/2023  (Modules 1-5)
- **Group Project Part 2**: 10/25/2023  (Draft and Bibliography)
- **Second Exam**: 11/6/2023  (Modules 6-10)
- **Group Project Part 3**: 11/29/2023  (Final Publication)
- **Final Exam**: 12/13/2023  (Modules 11-15, plus comprehensive)

**GRADING SCALE**

<table>
<thead>
<tr>
<th>Grade</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>94 - 100 %</td>
</tr>
<tr>
<td>A-</td>
<td>&lt; 94 - 90 %</td>
</tr>
<tr>
<td>B+</td>
<td>&lt; 90 - 87 %</td>
</tr>
<tr>
<td>B</td>
<td>&lt; 87 - 84 %</td>
</tr>
<tr>
<td>B-</td>
<td>&lt; 84 - 80 %</td>
</tr>
<tr>
<td>C+</td>
<td>&lt; 80 - 77 %</td>
</tr>
<tr>
<td>C</td>
<td>&lt; 77 - 74 %</td>
</tr>
<tr>
<td>C-</td>
<td>&lt; 74 - 70 %</td>
</tr>
<tr>
<td>D+</td>
<td>&lt; 70 - 67 %</td>
</tr>
<tr>
<td>D</td>
<td>&lt; 67 - 64 %</td>
</tr>
<tr>
<td>D-</td>
<td>&lt; 64 - 61 %</td>
</tr>
<tr>
<td>E</td>
<td>&lt; 61 %</td>
</tr>
</tbody>
</table>

**Passing Grade Points**

- A: 4.0
- A-: 3.67
- B+: 3.33
- B: 3.0
- B-: 2.67
- C+: 2.33
- C: 2.0
- C-: 1.67
- D+: 1.33
- D: 1.0
- D-: 0.67
- S: 0

Additional information on current UF grading policies for assigning grade points can be found here:
- [Grading policy](http://www.catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx)

**Course organization**

The module material of a given week will be made available the Sunday of the week before. Assignments will be due on the Friday of a given module week.

- **Module 0**: Introduction to the course
- **Module 1**: Definition of the rhizosphere and origin of roots
- **Module 2**: Root structure, functions, and modifications
- **Module 3**: Regulation of root growth
- **Module 4**: Classification and function of root derived products
Module 5: Root exudates and mineral nutrition
Module 6: Root system architecture and nutrient acquisition
Module 7: Legume-Rhizobia symbiosis
Module 8: Mycorrhizal fungi and nutrient acquisition
Module 9: Plant growth promoting rhizobacteria
Module 10: Drought and salt stress
Module 11: Heat and flooding stress
Module 12: Trace metals and emerging contaminants stress
Module 13: Stresses caused by pathogens
Module 14: Modern research techniques for field experiments
Module 15: Modern research techniques for laboratory experiments

Course schedule
8/23/2023  Introduction to the course. Module #1 opens
8/27/2023  Module #2 opens
9/1/2023  Module #1 and #2 quiz due
9/3/2023  Module #3 opens
9/4/2023  Labor Day
9/8/2023  Module #3 quiz due – Discussion #1 due
9/10/2023  Module #4 opens
9/15/2023  Module #4 quiz due
9/17/2023  Module #5 opens
9/20/2023  Group project part 1 due (outline)
9/22/2023  Module #5 quiz due – Discussion #2 due
9/24/2023  Module #6 opens
9/25/2023  First Exam (module 1-5) opens
9/29/2023  Module #6 quiz due
10/1/2023  Module #7 opens
10/2/2023  First Exam due (Modules 1-5)
10/6/2023  Homecoming 🎉 Go Gators! 🎉
10/8/2023  Module #8 opens
10/9/2023  Module #7 quiz due – Discussion #3 due
10/13/2023  Module #8 quiz due
10/15/2023  Module #9 opens
10/20/2023  Module #9 quiz due – Discussion #4 due
10/22/2023  Module #10 opens
10/25/2023  Group project part 2 due (draft and bibliography)
10/27/2023  Module #10 quiz due
10/29/2023  Module #11 opens
10/30/2023  Second Exam (Module 6-10) opens
11/3/2023  Module #11 quiz due – Discussion #5 due
11/5/2023  Module #12 opens
11/6/2023  Second Exam due (Modules 6-10)
11/10/2023  Veterans Day
11/12/2023  Module #13 opens
11/13/2023  Module #12 quiz due
11/17/2023  Module #13 quiz due – Discussion #6 due
11/19/2023  Module #14 opens
11/22/2023  Thanksgiving break
11/24/2022  🍁 Happy Thanksgiving! 🍁
11/26/2023  Module #15 opens
11/29/2023  Group project part 3 due (final publication)
11/27/2023  Module #14 quiz due
12/4/2023  Module #15 quiz due
12/6/2023  Final Exam (Modules 11-15, plus comprehensive)
12/13/2023  Final Exam due (Modules 11-15, plus comprehensive)

COURSE POLICIES

Attendance and Make-up Policy
Requirements for class attendance and make-up exams, assignments, and other work in this course are consistent with university policies that can be found at:


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

In-Class Recordings
Students are allowed to record video or audio of class lectures. However, the purposes for which these recordings may be used are strictly controlled. The only allowable purposes are: (1) for personal educational use (2) in connection with a complaint to the university, or (3) as evidence in, or in preparation for, a criminal or civil proceeding. All other purposes are prohibited.

Specifically, students may not publish recorded lectures without the written consent of the instructor. A "class lecture" is an educational presentation intended to inform or teach enrolled students about a
particular subject, including any instructor-led discussions that form part of the presentation, and delivered by any instructor hired or appointed by the University, or by a guest instructor, as part of a University of Florida course. A class lecture does not include lab sessions, student presentations, clinical presentations such as patient history, academic exercises involving solely student participation, assessments (quizzes, tests, exams), field trips, private conversations between students in the class or between a student and the faculty or lecturer during a class session.

Publication without permission of the instructor is prohibited. To “publish” means to share, transmit, circulate, distribute, or provide access to a recording, regardless of format or medium, to another person (or persons), including but not limited to another student within the same class section. Additionally, a recording, or transcript of a recording, is considered published if it is posted on or uploaded to, in whole or in part, any media platform, including but not limited to social media, book, magazine, newspaper, leaflet, or third-party note/tutoring services. A student who publishes a recording without written consent may be subject to a civil cause of action instituted by a person injured by the publication and/or discipline under UF Regulation 4.040 Student Policy on Course Syllabi Honor Code and Student Conduct Code.

- For more information regarding the Student Honor Code, please see: http://www.dso.ufl.edu/sccr/process/student-conduct-honor-code

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 when appropriate.

Canvas Technology Requirements
Computers, Internet, and Web browsers: Canvas runs on Windows, Mac, Linux, iOS, Android, or any other device with a modern web browser. It is recommended to use a computer less than five years old with at least 1GB of RAM. It is recommended to have a minimum Internet speed of 512kbps. It is strongly recommended to not use a wireless connection, phone, tablet, or notepad for critical course tasks such as exams and discussions.

Canvas currently supports the following browsers: Chrome, Safari, Firefox, Edge. Canvas supports the last two versions of most browsers. It is highly recommend updating to the newest version of whatever browser you are using. Note that your computer’s operating system may affect browser function. Failure to use one of these browsers will cause problems.

For more information on approved computers and browsers please visit: https://community.canvaslms.com/t5/Canvas-Basics-Guide/What-are-the-browser-and-computer-requirements-for-Canvas/ta-p/66

On this web page there is an area titled “Is My Browser up to Date?” Use it to check each computer and browser you may use in this course. There is another important area on “Browser Privacy Settings.” Read
the section(s) for any browser intended for use. Note that: in browsers such as Safari, insecure content will never be displayed in the browser. Return to the page to check for updates on technology issues in Canvas.

If you encounter technical difficulties in this course, contact the UF Computing Help Desk right away to troubleshoot. https://helpdesk.ufl.edu/ or (352) 392-HELP. If the problem cannot be fixed immediately, notify your instructor, and provide them with the Help Desk ticket number.

Services for Students with Disabilities

Students with disabilities requesting accommodations should first register with the Disability Resource Center by providing appropriate documentation. Once registered, students will receive an accommodation letter which must be presented to the instructor when requesting accommodation. Students with disabilities should follow this procedure as early as possible in the semester.

- Disability Resource Center, 0001 Reid Hall, (352) 392-8565, https://disability.ufl.edu/

Campus Helping Resources

Students experiencing crises or personal problems that interfere with their general well-being are encouraged to utilize the university’s counseling resources. The Counseling & Wellness Center provides confidential counseling services at no cost for currently enrolled students. Resources are available on campus for students having personal problems or lacking clear career or academic goals, which interfere with their academic performance.

- Counseling and Wellness Center, 3190 Radio Road, 392-1575, www.counseling.ufl.edu
  Counseling Services
  Groups and Workshops
  Outreach and Consultation
  Self-Help Library
  Wellness Coaching
- U Matter We Care, www.umatter.ufl.edu
- Sexual Assault Recovery Services (SARS), Student Health Care Center, 392-1161.
- University Police Department, 392-1111 (or 9-1-1 for emergencies), www.police.ufl.edu

Additionally, if you would like orientation on choosing a major, finding an internship, or planning your career, I encourage you to use the university’s on-campus resources.

- Career Connections Center, CR-100 Reitz Union, 392-1601, https://career.ufl.edu/
Course Evaluation Process
Student assessment of instruction is an important part of the effort to improve teaching and learning. At the end of the semester, you 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:
• Course evaluations, www.evaluations.ufl.edu

Evaluations are typically open during the last two or three weeks of the semester. You will be notified of the specific times when evaluations for this course are open. Summary results of these assessments are available to students at:
• Evaluations summary, www.evaluations.ufl.edu/results

Student Complaints
You can file and resolve any complaints about your experience in this course in the following site:
• Student complaints in residential courses, https://sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-code/
• Student complaints in online courses, http://distance.ufl.edu/student-complaint-process/