

BIO/NATSC 375: Soil Ecology with Laboratory

Time & Locations: MWF 1:10-2:00 in GHH 106

Laboratory Mon 2:15-5:05 in MNS 107

Instructor: Dr. Loren B. Byrne Phone: X 3890 Email: lbyrne@rwu.edu Office: 227 MNS
 Office Hours: By appt. ONLY, outside or online: good times are MWF @ 10:30 & 12pm; Tue @3:30

Quotes that summarize Dr. Byrne's teaching & learning philosophy & frame the dynamics of this course:

- "The mind is not a vessel to be filled but a fire to be kindled." ~ Plutarch*
- "Teachers open the door. You must enter by yourself." ~ Chinese proverb*
- "(Intelligence) is 1% inspiration and 99% perspiration." ~ Thomas Alva Edison*
- "Today a reader, tomorrow a leader." ~ W. Fusselman*
- "When we try to pick out anything by itself, we find it is tied to everything else in the universe." ~ John Muir*
- "High-quality learning is absolutely essential for high-quality living." ~ L. Dee Fink*

Course description (from the catalog):

This course serves as an in-depth exploration of soils as unique habitats for life with a focus on understanding variables that affect the abundance, diversity and interactions of terrestrial organisms and, in turn, their influence on soil physicochemical properties, biogeochemical cycles and other variables that impact the well-being and sustainability of human societies (e.g., agricultural production, clean water availability). Topics to be covered include soil food webs, microbial ecology, soil aggregate formation, carbon and nitrogen cycling, relationships between soils and aboveground ecology, and the effects of human activities on soil biodiversity. During laboratory sessions, students will explore the basic biology of soil organisms, conduct research projects, and learn methods for sampling soils and organisms in the field.

Fulfills a course requirement in the Biology Environmental Science and Sustainability Studies Core Concentrations

Prerequisites: BIO 104, and one of BIO 240, 320 or 360; or consent of instructor

Course goals for learning outcomes:

After this course, students should be able to:

- Describe the basic physicochemical properties of soils and their relationships to biological and ecological variables, and how those relate to human well-being
- Describe the basic biology, taxonomy and ecology of major groups of soil biodiversity
- Explain the fundamental biogeochemical processes that occur in soils
- Apply the above knowledge about soils and their ecology to interpreting and discussing solutions to contemporary societal and environmental problems facing humanity
- Synthesize their soil ecological knowledge with other topics to explain a deeper understanding of ecosystems, the earth system, and the sustainability of human societies across scales

In addition, during the course students are expected to:

- improve their skills for critically reading, writing, discussing and thinking about ecology
- increase their appreciation for and interest in learning more about soil organisms and ecology!

Required texts:

No required textbook. Assigned readings will be provided as hand-outs or on Bridges.

Requirements, assessment and grading (developed with student input)

Students' grades will be based on the following: % Value of final grade

Lecture section (70% of final grade)

- In-class and home work (e.g., half sheets, seminar discussion, presentations, etc.) 20
- Journal club (scientific or news article) presentation & participation 7
- Weekly learning reflection essays 25
- "Professor for a day" biodiversity presentations 18

Lab section (30% of final grade)

- Lab attendance & participation (incl. field trips) 10
- Project & other assignments TBD 20

Grading scale and the meaning of grades:

A= $\geq 93\%$ - Excellent	A- = 90-92.9% Great	B+ = 87-89.9% Very Good	B = 83-86.9% Good	B- = 80-82.9% Good
C+= 77-79.9% Average	C = 73-76.9% Average	C- = 70-72.9% Average	D = 60-69.9% Poor	F= $\leq 59.9\%$ Failure

BIO/NATSC 375 – Fall 2020 Semester schedule

Week	Lecture/discussion topic	Readings (IS= selections from intro soils books) Jigsaw indicates each student reads one of several assigned articles
1	8/26: Introductions & Mental Mapping 8/28: Why should we care about soil?	8/28: Dailey et al. 1997, Schimel 2010, McNeil and Winiwarter 2004
2	PART 1: What are the basic properties & processes of soils? 8/31: What is soil? A natural, dynamic, functioning body 9/2: How does soil form? Where does it come from? 9/4: weathering and movement of sediments	8/31: National Geographic article 9/2: IS 9/4: IS
3	9/7: ecological succession, pedogenesis & profile development 9/9: soil heterogeneity: taxonomy and mapping 9/11: soil physical properties I: color and texture	9/7: IS 9/9: soil order websites 9/11: IS
4	9/14: soil physical properties II: aggregate formation 9/16: soil physical properties III: agg. stability, BD & pores 9/18: soil chemical properties I: water	9/14: IS & Six et al. 9/16: Jastrow et al. 1998 9/18: IS
5	9/21: soil chemical properties II: mineralogy, fertility & CEC 9/23: The C cycle I: inputs & sequestration 9/25: The C cycle II: decomposition	9/23: Horwath 2007 (Ch 12) 9/25: Chapin et al. ch 7
6	9/28: The N cycle I 9/30: The N cycle II 10/2: Synthesis I: What is the soil system?	9/28: Chapin et al. ch 9 9/30: Groffman et al. 1988 10/2: TBD
7	PART 2: Who lives in the soil? Where? What do they do? 10/5: Introduction: taxonomy, limiting factors & habitat structure 10/7: bacteria 10/9: fungi	10/5: TBD 10/7: TBD 10/9: TBD
8	10/12: mycorrhizae and the rhizosphere 10/14: protozoans, rotifers, tardigrades 10/16: nematodes	10/12: TBD 10/14: TBD 10/16: TBD
9	10/19: earthworms 10/21: mites 10/23: arachnids	10/19: TBD 10/21: TBD 10/23: TBD
10	10/26: myriapods and isopods 10/28: non-insect hexapods: collembolans, diplurans, proturans 10/30: insects I	10/26: TBD 10/28: TBD 10/30: TBD
11	11/2: insects II 11/4: vertebrates 11/6: Synthesis II: soil food webs	11/2: TBD 11/4: TBD 11/6: jigsaw
12	11/9: Synthesis II continued: Student chosen - Biodiversity 11/11: Above-below ground interactions 11/13: Synthesis III: soil quality, health and sustainability	11/9: jigsaw 11/11: Baskin ch 8 11/13: TBD
13	PART 4: How have humans impacted soils? 11/16: Agriculture I: traditional vs organic 11/18: Agriculture II: IPM 11/20: Urbanization effects	11/16: Hendrix et al. 1986 11/18: TBD 11/20: Byrne 2006, PZ & Byrne 2009
14	11/23: Invasive species and soils 11/25 & 27: No class- Thanksgiving break	11/23: jigsaw
15	Online meetings: Dates & times TBD: Nov 30-Dec 4 Soils and global climate change Synthesis IV: future directions in soil ecology	TBD TBD

Required attendance at the final exam period: Dec 7, 2:45-4:45

****The professor reserves the right to modify this schedule at any time if necessary****
The laboratory schedule will be provided under separate cover.