Spring Semester 2017  
PSS 268 / NR 268 Soil Ecology

Lecture: MWF 9:40-10:30 am, Jeffords 127; Laboratory: R 8:30-11:15 or 1:15-4:00 pm, Jeffords 118  
4 credit hours: 3 hours lecture + 3 hours laboratory per week

**Lecture Instructor:** Deborah Neher, Jeffords 117B, 6-5390, dneher@uvm.edu  
**Laboratory Instructor:** Thomas Weicht, Jeffords 342, 6-0690(email is best), tweicht@uvm.edu  
**Teaching Assistant:** Vanessa Perillo, Jeffords 252, vperillo@uvm.edu  
*Office hours for all instructors is based on request for an appointment*

Course web page: Blackboard  
- Syllabus, lecture notes, laboratory exercises, required reading for lecture and laboratory,  
  Endnote database with primary literature, class project and paper details, useful URLs, study  
  guide, academic policies, and more.

**Course Description:** Underlying concepts and theory of modern soil ecology will be reviewed  
including spatial and temporal distributions, sampling methods, biogeochemical cycles, and  
ecological functions of soil. **Prerequisites:** PSS 161 Fundamentals of Soil Science and BCOR102  
Ecology, NR 103 or equivalent

**Textbooks:**  

**Learning Outcomes:**  
1. Quantify association between soil chemical and physical habitat with community composition  
   and activity.
2. Gain a working knowledge of the basic biology and ecology of plant-microbe, microbe-microbe,  
   and microbe-invertebrate interactions in soil
3. Hands-on experience with techniques to extract and quantify soil biological activity and  
   determine quantity soil biodiversity.
4. Link soil biology with ecosystem functions of nutrient cycling and decomposition
5. Compare the effect of management practices on soil food web structure and function, e.g.,  
   cultivation, crop rotation, fertilization, cover crops, fallow, compost amendments
6. Apply concepts of ecological succession of soil communities to environmental monitoring,  
   bioremediation, and biological control of disease.
7. Participate in original research, completing the scientific method from hypothesis generation to  
   data collection, data analysis, and technical reporting.
8. Conduct case study experiments to compare biological indicator scores of soils representing  
   contrasting soil quality from three farms in Vermont.
9. Analyze and interpret high throughput sequencing data from 16 rDNA extracted from soil of  
   three farms in Vermont.
10. Parameterize a systems model to estimate contribution of soil nematodes and protozoa to  
    availability of nitrogen to plants.

1) Attend and participate actively in all class discussions  
2) One midterm examination and a final examination (final is weighted 1.5 that of the midterm)  
   a) style: short answer, matching, multiple choice  
   b) includes topics from assigned reading, lectures and laboratory exercises
3) Laboratory participation and reports

4) **Graduate Students only:** Grant Proposal, must encompass the biology of at least one group of organisms and link with physical environment. All written assignments must be typed.
   a) Written Proposal (25 %) and oral presentation (15 %)
      **Deadlines:**
      March 10: Proposal outline with ≥ 3 primary literature sources identified
      April 19: Written grant proposals due
      April 28-May 3: Oral presentation to class

5) Critically review 2-3 grant proposals and evaluate all oral presentations
   **Deadlines**
   April 21: receive hardcopies of proposals to review
   April 28: written peer evaluations due
   April 28-May 3: peer review of oral presentations

Late submission of assignments is penalized.

**Weighting of Assignments in Course Grade:**
Undergraduate Students: 5% lecture attendance, 45% exams, 40% Lab, 10% peer review
Graduate Students: 35% exams, 25% Lab, 30% grant proposal, 10% peer review

**Important university dates:** January 30: Add/drop, audit, pass/no pass deadline; March 13-17: Spring Break; April 3: Last Day to Withdraw; Exam Days (May 8, 9, 11, 12)

**Expectations that are not involved with course grade:**
Read assigned material **before** class (whether lecture or laboratory)
Print out own laboratory exercises
Turn cell phone notifications off during class time.
Notify instructor of any ‘bad links’ on Blackboard for repair
<table>
<thead>
<tr>
<th>Date</th>
<th>Reading</th>
<th>Topic</th>
<th>Week</th>
<th>Date</th>
<th>Topic</th>
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<tbody>
<tr>
<td>Jan 18</td>
<td>1</td>
<td>Introduction and history of the discipline</td>
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<td>Jan 19</td>
<td>Introduction to Class Experiment, Setup Microcosms, Nitrogen #1</td>
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<tr>
<td>Jan 20-</td>
<td>2, pp.</td>
<td>Soil as a habitat for organisms and their interactions</td>
<td>2</td>
<td>Jan 26</td>
<td>Exercise 1. Soil Environment</td>
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<td>Feb 1 (6)</td>
<td>391-408</td>
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<td>Feb 3-6</td>
<td>8, pp.</td>
<td>Occurrence and distribution of soil organisms (rhizosphere,</td>
<td>3</td>
<td>Feb 2</td>
<td>Exercise 2. Protozoa setup Respiration #1</td>
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<tr>
<td>(2)</td>
<td>312-314</td>
<td>spatio-temporal patterns)</td>
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<td>Feb 8</td>
<td>CC 2</td>
<td>Primary production processes in soils</td>
<td>4</td>
<td>Feb 9</td>
<td>High throughput sequencing (part 1 of 2), Respiration #2</td>
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<td>Feb 10-27</td>
<td>3,4, BB</td>
<td>Secondary production: bacteria, archaea, fungi</td>
<td>5</td>
<td>Feb 16</td>
<td>Exercise 2. Ciliates &amp; flagellates Respiration #3</td>
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<td>Mar 1</td>
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<td>MIDTERM EXAM</td>
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<td>Feb 23</td>
<td>Exercise 2. Flagellates &amp; Amoeba High throughput sequencing (part 2 of 2), Respiration #4</td>
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<td>Mar 3-6</td>
<td>pp. 342-359, BB</td>
<td>Microbial growth &amp; decomposition - Tom 10: Proposal Outline Due</td>
<td>7</td>
<td>Mar 2</td>
<td>Exercise 2. Amoebae, Most Probable Number (MPN) Respiration #5 Nitrogen #2 High throughput sequencing report due</td>
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<td>Mar 10-27</td>
<td>5, BB</td>
<td>Secondary production: activities of heterotrophic fauna</td>
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<td>Mar 30</td>
<td>Exercises 4 &amp; 5 (con’t), Respiration #7, Nitrogen #3 Mycorrhizae Preparation</td>
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<td>March 29-31</td>
<td>BB</td>
<td>Energy and coupled flows through food webs - Tom</td>
<td>10</td>
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<td>April 3-5</td>
<td>pp. 360-77, 408-412, BB</td>
<td>Ecological function of soils: carbon cycling and soil organic matter</td>
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a number between parentheses indicates how many days of lectures on a particular topic
b chapter number in Paul text
c article(s) posted on class Blackboard site
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<thead>
<tr>
<th>Date</th>
<th>Week(s)</th>
<th>Pages</th>
<th>Main Topic</th>
<th>Date</th>
<th>Assignment/Activity</th>
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<tbody>
<tr>
<td>April 7-12</td>
<td>(3)</td>
<td>pp. 408, 547-8, 560-562</td>
<td>Composting / decomposition</td>
<td>Apr 6</td>
<td>Exercises 4 &amp; 5 (con't) Mycorrhizae enumeration</td>
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<td>April 14-17</td>
<td>(2)</td>
<td>14, 15</td>
<td>Ecological function of soils: nitrogen cycling</td>
<td>Apr 13</td>
<td>Exercise 6. Coupled Flow Model</td>
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<td>April 19-21</td>
<td>(2)</td>
<td>16, pp. 322-328</td>
<td>Ecological function of soils: mycorrhizae</td>
<td>Apr 20</td>
<td>Synthesis of case studies Data analysis &amp; graphing</td>
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<td>April 24-26</td>
<td>(2)</td>
<td>pp. 562-565</td>
<td>Applied soil ecology: Ecotoxicology</td>
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<td>Apr 28-May 3</td>
<td>(3)</td>
<td>4/28: Written evaluations of grant proposals due Graduate student presentations (2-3 per day)</td>
<td>Apr 27</td>
<td>Case Studies due</td>
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<td>May 5</td>
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<td>Recap and course evaluation</td>
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<td>May 11</td>
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<td>FINAL EXAM</td>
<td>10:30 am -1:15 pm, Jeffords 127</td>
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