GEOG 114A/ES 114A
Biogeochemistry of Soils
5 units
Fall Quarter 2017

Lectures: Monday and Wednesday, 2:00 – 3:15, Ellison 3621
Laboratory: Fridays 9:00 – 11:50 and 1:00 – 3:50, 2525 Phelps Hall
Instructor: Oliver Chadwick, 4803 Ellison Hall, oac@geog.ucsb.edu
Office hours: Monday and Wednesday 3:30 – 4:30 PM, and by appointment
TAs: Nina Bingham (nbingham@umail.ucsb.edu) Ellison 4807
Office Hours: Wed 12-2 PM
Kate Voss (katalynvoss@geog.ucsb.edu) Ellison 4809
Office Hours: TBD

Course Objectives:
This course is designed to provide students with an understanding of soil as a component of Earth’s biogeochemical system. We will focus on the unique global role soil plays as a living, breathing boundary at the terrestrial surface. This boundary is where geological substrate is acted on by chemistry that is conditioned by biological processes and mediated by water. We will examine soil from an academic and theoretical perspective in lecture using information drawn from chemistry, biology, agriculture and geology, but we will also examine soil from a practical ‘hands-on’ perspective in the laboratory exercises. The experiences you gain from this course will prove useful for future work in many different fields relating to the environment, agriculture, engineering, and the natural sciences. Like water, soil is a fundamental and limited natural resource. By the end of this course, I trust that you will never look at dirt in the same way.

Required Texts:
- Reader
- Lab Handouts

Grades will be determined as follows:

<table>
<thead>
<tr>
<th>Component</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Mid-term Exam</td>
<td>30%</td>
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<tr>
<td>Problem sets (2)</td>
<td>15%</td>
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<tr>
<td>Laboratory exercises</td>
<td>25%</td>
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<tr>
<td>Comprehensive final exam</td>
<td>30%</td>
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Problem sets and labs must be handed in at the beginning of class on the date they are due. Late materials will lose 10% per day late and no work will be accepted after assignments are returned.

Class Procedures:
This course covers a lot of material. Timely reading of assigned material will be of great help. Lectures will generally follow the text material but may also bring in outside materials. Not all material in the assigned readings will be directly covered in lecture, but ALL material assigned will be considered fair-game for tests and problem sets. Questions are welcome and encouraged at any time. There will be a mid-term exam and a comprehensive final exam. The exams are scheduled in advance: no make-ups will be given without prior permission of the instructor.
## Class Schedule

<table>
<thead>
<tr>
<th>Lecture Date</th>
<th>Topic</th>
<th>Reading Assignment</th>
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<tbody>
<tr>
<td>Oct. 2</td>
<td>Soil as Critical Resource</td>
<td>Chpt. 1: 1-31</td>
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<tr>
<td>Oct. 4</td>
<td>Parent Material and Soil Profiles</td>
<td>Chpt. 2: 33-82</td>
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<td>Oct. 6</td>
<td>Lab 1: Campus Soils, intro to soils</td>
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<tr>
<td>Oct. 9</td>
<td>Soil Profiles and Models of Soil Formation</td>
<td>Chpt. 2: 33-82</td>
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<td>Oct. 11</td>
<td>Soil Classification</td>
<td>Chpt 3: 83-128</td>
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<td>Oct. 13</td>
<td>Lab 2: More Mesa, soil spatial relationships pt. 1</td>
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<td>Oct. 16</td>
<td>Soil Physical Properties</td>
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<td>Oct. 18</td>
<td>Soil-Water Energetics</td>
<td>Chpt. 4: 130-185</td>
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<td>Oct. 20</td>
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<td>188-199</td>
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<td>Oct. 23</td>
<td>Soil-Water Storage and Movement</td>
<td>Chpt. 5: 200-230</td>
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<td>Oct. 25</td>
<td>Soil Atmosphere – Oxidation-Reduction Reactions</td>
<td>Chpt. 6: 233-244</td>
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<td>Oct. 27</td>
<td>No Lab</td>
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<tr>
<td>Oct. 30</td>
<td>Thermal Properties of Soil</td>
<td>Chpt. 7: 284-294</td>
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<td>Nov. 1</td>
<td>Mineral Weathering and Colloid Formation</td>
<td>Chpt. 8: 327-369</td>
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<td>Nov. 3</td>
<td>Take-home exam (out), No Lab</td>
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<td>Nov. 6</td>
<td>Physical and Chemical Properties of Colloids</td>
<td>Chpt. 8: 327-369</td>
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<td>Nov. 8</td>
<td>Colloids and Ion Exchange</td>
<td>Chpt. 8: 327-369</td>
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<td>Nov. 10</td>
<td>Take-home exam (returned), No Lab</td>
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<td>Nov. 13</td>
<td>Soil Acidity and pH Buffering</td>
<td>Chpt. 9: 374-415</td>
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<td>Nov. 15</td>
<td>Acid and Alkaline Soil Management</td>
<td>Chpt. 10: 420-461</td>
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<td>Nov. 18</td>
<td>Lab 3: Sedgewick, soil spatial relationships pt. 2</td>
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<td>Nov. 20</td>
<td>Soil Organisms</td>
<td>Chpt. 11: 464-521</td>
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<td>Nov. 22</td>
<td>Thanksgiving (no class)</td>
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<td>Nov. 24</td>
<td>No Lab</td>
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<tr>
<td>Nov. 27</td>
<td>Soil Organic Matter and Carbon Cycle</td>
<td>Chpt. 12: 526-579</td>
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<td>Nov. 29</td>
<td>Nitrogen Cycle and Management</td>
<td>Chpt. 13: 583-625</td>
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<td>Dec. 1</td>
<td>Lab 4: Soil Information Systems</td>
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<td>Dec. 4</td>
<td>Phosphorus Cycle and Management</td>
<td>Chpt. 14: 643-675</td>
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<td>Dec. 6</td>
<td>Summary and Review</td>
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<td>Dec. 8</td>
<td>No lab</td>
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<tr>
<td>Dec. 11</td>
<td>Comprehensive Exam – 4 to 7 PM</td>
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### Important Campus Resources
Campus Learning Assistance Services: (893-3269, www.clas.ucsb.edu) helps students increase their mastery of course material through course-specific tutoring and academic skills development. CLAS has tutorial groups and individual drop-in writing tutors available numerous hours during the week (see the web site for schedules). You may also make an appointment to meet with a writing tutor at the main office, Building 477, from 9-5 M-F.

Disabled Students Program: (893-2668, www.sa.ucsb.edu/dsp) provides academic support services to eligible students with temporary and permanent disabilities. You must register with DSP prior to receiving these accommodations. If you are a student with a disability and would like to see me to discuss special academic accommodations, please contact me during my office hours or after class.

***Cheating or plagiarism in any form will result in a 0 (zero) for that exam or assignment and may also result in dismissal from class with a grade of F or further disciplinary action. See the following website for more details: http://hep.ucsb.edu/people/hnn/conduct/disq.html#over