

**Biology 345 Nutrient Transformations**  
**Syllabus Spring 2017**

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Office Hours: M 12-1, T 1-2, F 9:40-10:40, and by appointment

Lecture: LS 307 MWF 1:10-2:10

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**The Goals of the Biology Curriculum**

The Biology Department's curriculum is designed to introduce you to foundational themes that run throughout the field of biology and to develop skills essential for success after graduation. Each course in the curriculum will enable you to expand your knowledge of the terms and concepts of the field so that you can understand how to think like a biologist. Each course in the curriculum will also provide you with opportunities to develop your skills so that you will be effective and competent in whatever career you choose to pursue after graduation.

**I. Themes**

- a. Evolution: The process of evolution is responsible for generating the diversity of life on Earth.
- b. Biodiversity: Organisms comprise major lineages descended from common ancestors, and their characteristics impact their survival and distribution.
- c. Systems: Biotic and abiotic components of the biosphere interconnect and interact.
- d. Information Flow: All living processes derive from the expression of genetic information in context.
- e. Energy/Matter Transformation: Biological systems work by transforming matter and energy according to physical laws.
- f. Structure/Function Relationships: Structure and function are linked in all living things.

**II. Skills**

- a. The ability to apply the process of science
- b. The ability to communicate biological concepts and their applications effectively
- c. The ability to apply quantitative reasoning to biological questions
- d. The ability to connect the themes across all levels of biological organization and with the fields of chemistry, physics, and math

**COURSE DESCRIPTION**

An overview of nutrient movement through ecosystems, including carbon, nitrogen, phosphorus, and sulfur. Topics include weathering, biological redox processes, trace gas fluxes, controls on atmospheric gases, and how human activities are altering these processes. This course takes a holistic approach to understanding how nutrient transformations occur in soils, plants, oceans, and the atmosphere. The integrative nature of nutrient transformations requires the application of quantitative reasoning and tools from a variety of scientific disciplines, such as chemistry, physics, and math as listed in Skills C and D. We will focus extensively on the themes of systems and energy/matter transformations.

**INTENDED LEARNING OUTCOMES**

By the end of the course students will be able to

- Explain how nutrient cycles (C, N, and P) are different from one another
- Describe the major ecosystem inputs and outputs of C, N, and P as well as the movement of these nutrients through the atmosphere, lithosphere, and biosphere
- Describe and visually represent how disturbances influence ecosystem processes
- Illustrate the Earth's energy budget and how greenhouse gases influence that budget

**REQUIRED TEXT:**

Schlesinger WH, Bernhard ES. Biogeochemistry: An analysis of global change. 3<sup>rd</sup> ed. Academic Press: Amsterdam. ISBN 978-0-12-385874-0

All other readings will be posted on Inquire.

**DELIVERY AND FRAMEWORK OF COURSE**

This course consists of three one-hour lecture meetings each week. During class, we will engage in a variety of activities, including lectures, group work, and discussions. Any Powerpoints from class, including text, illustrations, and photos, will be posted on Inquire after class, however students are encouraged to take notes as I do write on the board often. Discussion and questions raised by students are encouraged, which may alter our timetable. Therefore, there is some flexibility in the course schedule and may be adjusted throughout the semester.

The assigned readings are extremely important for this course. Textbook readings will provide the foundation of information needed for lectures. It is not anticipated that you will understand everything while reading so please bring those questions to lecture. When reading assigned papers, it is often easiest to print out the paper and make notes on the paper. We will also discuss the papers in class, so having a copy with you will facilitate discussion

**TIME EXPECTATIONS:**

Our Academic Catalog states (p. 43): "For each one-unit course, students are expected to complete 12 hours of work inside and outside of class each week", so you should expect to spend at least 12 hours each week on this course (both inside and outside of class).

**GRADE DETERMINATION:**

Items	Percent
Exams	35%
Final Exam	17%
Small HW/Lecture activities/Discussion	18%
Weekly Summaries and FWAs	18%
LIDET	10%
Seminar	2%

This grading scheme may vary if we add or subtract an assignment. You can always calculate your grade by dividing the number of points you have earned by the total number of points available to date. I will do my best to keep Inquire updated, but you will have your graded assignments and can calculate your own grade throughout the semester.

**COURSE POLICIES:**

**ATTENDANCE** in class is expected. Missing class will affect your ability to do well in the course. If you are really sick, please stay home. Students who are not in class for participation, quizzes, or discussions will earn zeroes (more information below).

**CLASS TIME IS OUR TIME:** You have my undivided attention; please return the courtesy. During class, your cell phones must be set to vibrate only (or turned off) and put away. Students who violate this policy after an instructor warning will lose 1% from their final grade for each infraction. Any cell phone use during an exam is strictly prohibited and is grounds for being charged with a violation of Academic Integrity. Students may not leave class to use their phones.

Students using laptop computers for taking notes in class must disconnect their wireless capability and must NOT be multitasking during class (checking e-mail, updating Facebook, instant messaging, Skyping, surfing the Internet, or any other activity). Playing on one's computer during class is rude and distracting to other students. Students who violate this policy after an instructor warning will lose 1% from their final grade for each infraction. By the way, research (Mueller and Oppenheimer, 2014) shows that taking notes by hand is more effective for memory retention than typing your notes.

Mueller PA, Oppenheimer DM (2014) The Pen is Mightier Than the Keyboard: Advantages of Longhand Over Laptop Note Taking. *Psychological Science* 25:1159-1167.

**EXAMS** Students are expected to take the exams on the dates indicated during the allotted class period. Students who miss exams will earn a zero grade except in exceptional cases. Any student seeking to take an exam at a time other than when it is scheduled must receive permission in advance of the exam (again, except in exceptional cases). Any student arriving late to an exam will not have extra time. The final exam will be cumulative.

**GRADED LECTURE ACTIVITIES** include group work, small in class writings, discussions, and quizzes. Quizzes may or may not be announced ahead of time. Because these activities are related to class activities, they cannot be made up or turned in late. Students absent on the day of the activity will earn a zero. To accommodate illness and other reasons for missed work, the lowest two grades in this category will be dropped. Students will work independently on all assignments and quizzes unless other instructions are given in writing.

The majority of **FWAs** are required, however you get to choose which weekly summaries you write. If you do additional assignments that is fine, but they will not count as extra credit. Be sure to read the guidelines for each assignment to ensure that you receive full credit. All assignments are due by class time, 1:10pm on the day they are due. If an assignment is turned in late, points will be lost based on the table at the top of the next page.

#### **WRITTEN ASSIGNMENT REQUIREMENTS:**

If you have read through the assigned material and/or spend an appropriate amount of time reading through the relevant sections of your text or reliable sources online. Homework that is simply text **MUST** be typed. Homework that requires diagrams, or solving problems can be hand-written or typed. Please be sure that your handwriting is legible so that you can receive maximum credit.

Length: All papers must be at least as long as the minimum length indicated. More specifically, a 1-page paper must have 23 lines of text (no larger than 12 pt, with 1 inch margins, double-spaced), not including any header information (e.g., name). This means that a "1-page paper" may require at least two sheets of paper. A 1.5-page paper should have 34 lines, a 2-page paper should have 46 lines, and so on. Any paper less than the required length will receive an automatic % reduction corresponding to the shortness of the paper. For example, if the paper is 10% shorter than, I will automatically deduct 10% off the grade assigned.

**LATE POLICY:** Late assignments will be accepted up to 7 days after the due date, however assignments turned in late will be penalized 10% for every day they are late, immediately starting after they are due. All assignments are due by the beginning of class on the day they are due.

**DEPARTMENT SEMINARS:** Students will attend two department seminars to earn 2% of their course grade. To earn credit students will arrive on time, stay for the entire seminar and questions, and be professional (i.e., pay attention to the seminar, not use electronic devices, not be disruptive). At the end of the seminar, students will sign an attendance sheet. You will also need to write a 1 page, double spaced summary of seminar, which is due 1 week after the seminar. Check the schedule now. If you cannot attend two you will need to make

alternative arrangements; such arrangements must be made prior to midterm. Signing the attendance sheet for someone else, or signing for a seminar that was not attended, is a violation in academic integrity.

**ACADEMIC INTEGRITY:** I follow the Academic Integrity Code of Roanoke College. Being uninformed is not an excuse. Please consult me for any integrity-related question you may have. Cell phones and other electronics may not be used in the room during an exam – this will be considered an academic integrity violation, as will the use of ANY material not permitted by the instructor. Taking exams out of the lecture room or instructor's office or making copies of exam questions is prohibited. All work for this course will be 100% original student effort. Using, old exams, papers or other material from previous/other courses or sections is not permitted.

**THE OFFICE OF DISABILITY SUPPORT SERVICES**, located in the Goode-Pasfield Center for Learning and Teaching in Fintel Library, provides reasonable accommodations to students with identified disabilities. Reasonable accommodations are provided based on the diagnosed disability and the recommendations of the professional evaluator. In order to be considered for disability services, students must identify themselves to the Office of Disability Support Services. Students are required to provide specific current documentation of their disabilities. Please contact Richard Robers, M.A. Ed., Coordinator of Disability Support Services, at 540-375-2247 or e-mail [robers@roanoke.edu](mailto:robers@roanoke.edu).

**THE WRITING CENTER @ Roanoke College**, located in Room 15 on the Lower Level of Fintel Library, offers writing tutorials for students working on writing assignments/projects in any field. Writers at all levels of competence may visit the Writing Center at any point in their process, from brainstorming to drafting to editing, and talk with trained peer writing tutors in informal, one-on-one sessions. The Writing Center is open Sunday through Thursday from 4 to 9 pm. Simply stop in, or schedule an appointment by going to [www.roanoke.edu/writingcenter](http://www.roanoke.edu/writingcenter), where our schedule of writing workshops and creative writing playshops is also posted. Questions? Email [writingcenter@roanoke.edu](mailto:writingcenter@roanoke.edu) or call 375-4949. You can also Like our page on Facebook!

#### **EXCEL**

We will be using excel in this course for several assignments and occasionally in class. If you are not familiar with excel the assignments may take longer than you anticipate so please plan accordingly. You will be using excel to perform calculations, make graphs and do statistical analyses. If you prefer another program to do these things for you that is fine but be aware most data will come in an excel format.

#### **PERSONAL NOTE FROM DR. STEINWEG:**

I want each of you to succeed in this class. At any time if you are struggling or having a hard time with the material please come and see me. I won't always give you the answer but I will find a way to help you find the answer. Send me an email or call my office phone and if I'm free I'll respond, otherwise we can set up an appointment at a mutually convenient time. If you email me you can expect a reply within 24 hours.

## Nutrient Transformations Tentative Lecture and Reading Schedule

I do reserve the right to change the syllabus if the pace at which we are going through the material warrants a change.

I will not change exam dates unless there are extreme circumstances (the campus closes).

If anything changes students will be given notice in class, via emails or on Inquire

Week	Topic	Reading and Assignments
1 1/16 1/18 1/20	Atmosphere, energy budget and dirty windows	<ul style="list-style-type: none"> <li>W Reading: "How do we know..." link on notes; BGC p49-58,63-65</li> <li>F Reading BGC 38-41; solar irradiance HW due</li> </ul>
2 1/23 1/25 1/27	Temperature, solar irradiance, earth system feedbacks	<ul style="list-style-type: none"> <li>F No class 1/27 – listen to "My Grandson the Rock" – link in notes; read Walker 1984 and answer questions</li> </ul>
3 1/30 2/1 2/3	Solar system, early earth, atmosphere comparison to other planets Rock weathering	<ul style="list-style-type: none"> <li>M reading BGC 15-28; systems feedback HW due</li> <li>W reading p28-31, 41-47</li> <li>F reading BGC p 93-104</li> </ul>
4 2/6 2/8 2/10	Rock weathering, P cycle, soils, erosion	<ul style="list-style-type: none"> <li>M reading p210-211, 462-464</li> <li>W Jenny's PDF p 13-20 and "What is Soil" reading and answer questions</li> <li>F reading BGC p111-117, 168-171; NebGuide and answer questions</li> </ul>
5 2/13 2/15 2/17	Soils, RUSLE	<ul style="list-style-type: none"> <li>M: RUSLE reading and answer questions</li> <li></li> <li>F: EXAM I</li> </ul>
6 2/20 2/22 2/24	Agricultural systems, N & P, dead zone	<ul style="list-style-type: none"> <li>M reading: Smil paper and Carpenter 2008, answer discussion questions</li> <li>W reading: Fowler 2013 and answer questions; BGC p447-454</li> <li>F: <b>FWA Final soil assignment due</b></li> </ul>
7 2/27 3/1 3/3	Deadzone, Oceans and fertilization	<ul style="list-style-type: none"> <li>M reading: BGC p352-357; dead zone data and laptops</li> </ul>
8		<ul style="list-style-type: none"> <li><b>Spring Break (no class all week)</b></li> </ul>
9 3/13 3/15 3/17	Oceans and climate	<ul style="list-style-type: none"> <li>M reading BGC p 341-346; watch ocean circulation video and answer ocean HW questions</li> <li>W reading: "Climate forecasting and adaptation" and answer questions</li> <li>F reading: BGC p365-373; <b>FWA Deadzone HW assignment due</b></li> </ul>
10 3/20 3/22 3/24	Oceans and climate, El Nino, La Nina, systems@play	<ul style="list-style-type: none"> <li>M reading "Anomaly to Oscillation"; BGC p347-348</li> <li>W reading "Climate family"</li> </ul>

11 3/27 3/29 3/31	Exam II Intro to LIDET Balance between pns and decomp	<ul style="list-style-type: none"> <li>• M: Exam II</li> <li>• W: bring laptops for LIDET intro;</li> <li>• F: <b>FWA North atlantic climate variability assignment due</b></li> </ul>
12 4/3 4/5 4/7	Balance between pns and decomp Litter C:N, soil organic matter Mtg with Dr. S – no class on 4/7	<ul style="list-style-type: none"> <li>• M: read Odum 1969 and answer questions; BGC p168-171, 156-159</li> <li>• W: BGC p188-191, 195-200</li> <li>• Th/F: LIDET question and analysis plan due – no class, meet with Dr. S <b>F: FWA Nitrogen fertilization assignment due;</b></li> </ul>
13 4/10 4/12 4/14	NEP, NPP, GPP, Rh, Ra Ecosystem disturbance scenarios	<ul style="list-style-type: none"> <li>• M reading: BGC p 135-137,141-150</li> <li>• W reading: BGC p153-163</li> <li>• <b>No class 4/14 (Good Friday)</b></li> </ul>
14 4/17 4/19 4/21	Ecosystem disturbance scenarios LIDET presentations Evidence for climate change	<ul style="list-style-type: none"> <li>• M reading: BGC p213-215</li> <li>• W: LIDET presentations due</li> </ul>
15 4/24	Wrap-up	
5/1	<b>Cumulative Final Exam</b>	Monday, May 1 <sup>st</sup> 2-5pm

\* The reading schedule is based on what you need to have read before coming to class. As an example, W reading needs to be read before coming to class on Wednesday.

\*\*I have not included the weekly summary due dates on the schedule since you only need to complete 4 of the 9 possibilities.