

EV 211, Block 2, 2015

Barnes

Human Impacts on Biogeochemical Cycles

Professor: Dr. Rebecca Barnes

Email: rebecca.barnes@coloradocollege.edu

Office: Tutt 130F

Paraprof: Kelsey Elwood (kelsey.k.elwood@coloradocollege.edu)

EV Technical Director: Darren Ceckanowicz (darren.ceck@coloradocollege.edu)

Office hours: We will be together a lot – if you need to meet with me outside of class time just set up a meeting via email or in class, I am happy to meet with you.

In this course we will explore the large biogeochemical cycles of our planet (N, C, P, S) plus water. By the end of the block you should know how they work (i.e. the chemical, biological, and geological mechanisms that drive them) and how humans have altered them (e.g. burning of fossil fuels, acid rain, land clearing). We will explore this intersection through multiple projects that will rely introduce you to basic modeling, lab and field techniques.

Course Format:

Class will begin every morning at 9 AM unless otherwise noted. There will be a lab (inside, in the field, in the lab – it really depends on the day) on almost all days, except Friday. Morning sessions will usually last until about noon and will rely on you doing the reading so that class discussions are not completely boring. While there are no field trips in the class – we will be working outside and in the lab during week 2, so be prepared to go outside. As a professor of mine once said – there is no such thing as bad field conditions, just bad field clothes – i.e. unless there is lightening or it is otherwise dangerous to be outside, we will go.

Attendance:

We will be covering a lot of material in this course, with every day building on the previous day. Therefore it is necessary that you show up for *every* class, with the exception of lab days marked as optional on the schedule. For any single *unexcused absence*, your overall course grade will drop 3%. If you have two unexcused absences, the Dean of Students will be notified. Please note that if you get sick during the block I will do everything I can to help you catch up on the material – but you *must* have a note from Boettcher.

If you need to miss class for any justifiable reason during the block (e.g., athletic team travel, religious observance), please notify me **today** so we can make arrangements on how you will receive the material for that day.

Canvas & Online Questions: I will use Canvas extensively throughout the course. I will do my best to have everything posted multiple days in advance but always by 4 PM for the following day. In addition, there will be questions posted that you must complete each night (with the exception of evenings before quizzes). The goals of these questions is for me to (1) assess your comprehension on material, (2) to get you to start thinking about the material prior to classroom

discussions, and (3) introduce you to how I ask questions so you are better prepared for quizzes. I realize that sometimes life happens and you aren't able to devote as much time as you want to your courses – therefore, you will be able to drop your three lowest scores on these questions.

Projects:

These are short descriptions of the aims of the projects. Specific, detailed instructions will be given separately at the start of each project.

Carbon Plot Project

For this project you will work in teams of 3 or 4 to quantify the carbon stocks and fluxes of a plot of land. Once you have collected the data you will then model it and try and estimate any stocks or fluxes that were not included in our measurements. Each group will have their own plot and each plot will represent a different land cover (e.g. the quad, the CC garden, the banks of Monument Creek). You will turn in a short (~5 page) paper that describes your methodology, results and model.

Campus N Footprint Project

Colorado College is a part of a larger national project to determine the drivers of campus nitrogen footprints. You will work in groups (3 to 4) to quantify the N footprint of our campus and consider the effects of various scenarios on our N footprint (e.g. if the campus achieves it's goal of carbon neutrality by 2020 what will that do to the N footprint? If the campus instituted Meatless Mondays, how would that change things?). You will turn in a short (3 page max) memo on your findings.

Final Project

For your final project you will work with a partner to investigate a topic of your choosing that fulfills the project scope. Each project idea needs to identify the ecosystem(s) of interest, the biogeochemical cycle(s) of interest and the perturbation. You can choose to compare one perturbation in multiple ecosystems OR examine how coupled biogeochemical cycles in one ecosystem are altered by a perturbation. I will provide you a list of ideas on Canvas (though you are welcome to come up with your own). Each student will turn in an annotated bibliography and work with their partner on a presentation.

Grading:

STELLA models	10%
Online Canvas questions (3 lowest scores dropped)	10%
Quizzes	35%
C & N Projects	30%
Final Project	15%

Grade Assignment ("+" and "-" will also be given when appropriate):

A = 90-100%

B = 80-89%

C = 70-79% S = 70-100%

D = 65-69% CR= 65-69% NC = below 65%

D+, D, CR, and NC does not fulfill EV Department major requirements.

Late assignment policy:

Late assignments will get a deduction of 1/3 of a letter grade for every day it is late (part of 1 day counts as a day). For example, if the paper is due Monday at 9AM and you turn it in at 3PM on Monday, that would count as being 1 day late and the grade would go from a B to B-.

Honor Code:

Failure to properly document sources in papers, plagiarism, copying from other student's work, or turning in assignments that have already been submitted for credit in other courses are among some of the actions considered intellectual theft under the Colorado College Honor System. I encourage you to work together and talk through issues, but your final written work must be your own. I will give you further information on how the honor code applies to specific assignments as we go. If you are uncertain about the Honor Code's application to a particular project, please ask me. If you have questions or to read further details of the Honor Code see:

<http://www.coloradocollege.edu/other/honorcouncil/constitution-bylaws/constitution.dot>

Disability Accommodations

If you have a disability and require accommodations for this course, please speak with me privately as soon as possible so that your needs may be appropriately met. If you have not already done so, you will need to register with Accessibility Resources (Learning Commons in Tutt Library, 227-8285), the office responsible for coordinating accommodations and services for students with disabilities.

Tentative Course Schedule (next page)

The course will be broken up into ~3 sections: chemistry basics & water cycling, carbon cycling, and nitrogen cycling.

Everything on the syllabus and schedule is subject to change.

Day	Time	Topic	Reading (for that day)	Assignments + nightly Canvas questions
9/21/2015	AM	Course Introduction, Causal Loops & Feedbacks		
	PM	<i>Optional class</i> - unit conversions		
9/22/2015	AM	Chemistry Basics - what is matter, atoms & periodicity, ideal gas law, chemical reactions	C&C pgs 15-27, 53-57, 115-119	Download and install 30 day trial of STELLA. I strongly encourage you to look over the STELLA tutorial documents
	PM	Models & Introduction to STELLA	<i>Cohen 1995</i>	
9/23/2015	AM	Chemistry Basics - formal charges, lewis structures, chemical bonding	C&C pgs 57- 62, 104-112	STELLA Population Model due 9 AM
	PM	STELLA - Water Cycle	<i>Oki et al. 2006</i>	
9/24/2015	AM	Water & Elemental Cycling (Redfield Ratios, Stoichiometry, Residence Time)	Weathers et al. Chapter 5, Vitousek et al. 1997	STELLA Water Cycle Model due 9 AM
	PM	<i>Optional class - review</i>		
9/25/2015	AM	Quiz 1		
	PM	<i>No Lab</i>		

9/28/2015	AM	Properties of H ₂ O; Humans & Freshwater	C&C 195-213, Postel et al 1996 <i>or</i> Vorosmarty et al. 2010	
	PM	Field/Lab: Above Ground Biomass, Soil Sampling		
9/29/2015	AM	Terrestrial Carbon Cycle	Weathers et al. Chapter 6; <i>Joos et al. 2002 & Schulze 2002</i>	
	PM	Field/Lab: Soil Respiration and Leaching of C		
9/30/2015	AM	Aquatic Carbon Cycle	one article from list on Canvas	
	PM	Lab: Soil, Plant & Soil Extract Analysis		
10/1/2015	AM	Global Perturbation of C cycle	one article from list on Canvas	STELLA Carbon Cycle Model due 9 AM
	PM	Work on Carbon Plot Project		
10/2/2015	AM	Quiz 2		
	PM	<i>No Lab</i>		

10/5/2015	AM	Nitrogen Cycle & Redox	Weathers et al. Chapter 7 & Redox primer	Carbon Plot Project due 9 AM
	PM	<i>Optional Lab Help Session w/Kelsey</i>		
10/6/2015	AM	Atmospheric N Deposition & Acid-Base	C&C pgs 234-251 & one article from list on Canvas	
	PM	Lab: N Footprint	Leach et al. 2012	
10/7/2015	AM	Agriculture & Nitrogen Cycle	one article from list on Canvas	Nitrogen STELLA model due 9 AM
	PM	Lab N Footprint Scenarios		
10/8/2015	AM	Global Perturbation of N cycle	one article from list on Canvas	
	PM	Work on N Footprint Scenario projects		
10/9/2015	AM	Quiz 3		
	PM	<i>No Lab</i>		

10/12/2015	AM	a bit about Phosphorus & Sulfur	Weathers et al. Chapter 8; Schlesinger & Bernhardt 471-482	N footprint memo due 9 AM
	PM	Intro to Final Project		Final Project Idea due 10 PM
10/13/2015	AM	Work on Final Projects		
	PM			Annotated Bibliography due 4 PM
10/14/2015	AM	Final Project Presentations		
	PM			

If a reading is in italics then you only need to be familiar with it – i.e. skimming, focusing on figures and tables is fine – we will use these as the basis for some of the modeling work.