

GEOL 4600/GEOG 8500
INTRODUCTION TO THE CRITICAL ZONE
Syllabus – Fall 2015

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Office Location: DSC 270
Office Hours: Mon 11 – 1; Wed 2:30 – 4 or by appointment

Course Time: Mon/Wed 10:00 – 11:15

Course Location: DSC 280

Text: All materials will be available on Blackboard and may be printed ahead of class and class communication will be via email accounts listed on Blackboard

Course Website: http://serc.carleton.edu/s/integrate/critical_zone/index.html

Class Objectives: The overall objective of the course is to describe and characterize how interactions among the atmosphere, lithosphere, hydrosphere, biosphere, and soil (combined = The Critical Zone) support and influence life.

The introductory portion of this course will provide participants with the framework for considering Critical Zone (CZ) science. Here the CZ will be introduced, stressing the importance and overall state of the CZ, and the temporal and spatial scales at which the CZ may be studied. CZ science will be described as an interdisciplinary and international pursuit, stressing the observatory and environmental gradient approach, and outstanding questions in CZ science will be discussed. The introduction will address how to obtain basic existing information mostly from various federal agencies to help understand the CZ. These activities will culminate in an introduction to the basic concepts of system modeling.

The body of the course will focus on cross-disciplinary science in the CZ and will focus on the large quantity of interdisciplinary data available from the existing NSF-funded CZOs. The material will be organized topically in the following categories: Methods in CZ Science; Land-Atmosphere exchange; Water transfer through the CZ; Landform and landscape evolution; and, Geochemistry and Biogeochemistry. The final portion of the course, Humans in the Critical Zone, specifically looks at the impact and role of humans and societies within the CZ. This last module focuses on how interdisciplinary and collective CZ science is accomplished, with consideration of the state and management of the CZ. The course overall takes advantage of the scientific literature and hands-on learning activities that access CZO data.

By the end of the course, students will be able to:

- 1) Identify Grand Challenges that face humanity and societies, ways in which humans depend upon and alter the Critical Zone, and the potential role for Critical Zone science to offer solutions for these challenges.
- 2) Use and interpret multiple lines of data to explain Critical Zone processes.
- 3) Evaluate how the structure of the Critical Zone influences Critical Zone processes/services.
- 4) Analyze how water, carbon, nutrients and energy flow through the Critical Zone and drive Critical Zone processes.

Evaluation Tools: You will be evaluated on your understanding of the material through a series of in class and homework exercises. Attending class is vital to your success and will enable you to get the most out of the course. Weekly assignments and due dates will be discussed in class and posted on

Blackboard – please check the site frequently. A semester-long project will include a 10-page paper and a 10-15 minute presentation.

Grading: Your grade will be determined from your performance on the semester-long project as well as classroom and homework activities.

Semester-long project (paper and presentation): 25%

Class and homework activities: 75%

Grades will be assigned as follows: A = 90-100, B = 80-89, C = 70-79, D = 60-69 and F < 60. This rubric may be scaled down during the semester depending on class performance. If in doubt about your grade, please see me. Earlier is always better!

Field Trip: I am working hard to organize a field trip in October and will keep you posted!

Academic Integrity: It is assumed that materials you turn in will reflect your work and will meet the guidelines on cheating and plagiarism set by the University. Cheating of any kind will not be tolerated and will result in automatic failure of the course.

Students with special needs: In accordance with UNO's Office of Diversity and Equal Opportunity: "Accommodations are provided for students who are registered with Disability Services and make their requests sufficiently in advance. For more information, contact Disability Services (EAB 117, Phone: 554-2872, TTY: 554-3799) or go to the website: www.unomaha.edu/disability." If you would like to take advantage of this, please see me.

Tentative Schedule (subject to change!):

Date	Lecture Topics	Date	Lecture Topics	Summative Report
Aug. 24	Pre-assessment Unit 1.1: CZ Overview	Aug. 26	Unit 1.1: CZ Overview	
Aug. 31	Unit 1.2: Role of Soils	Sep. 2	Unit 1.2: Role of Soils	
Sep. 7	<i>No Class</i>	Sep. 9	Unit 1.3: Systems Models	Paper topic
Sep. 14	Unit 2.1: Basic Tools & Analysis	Sep. 16	Unit 2.1: Basic Tools & Analysis	
Sep. 21	Unit 2.2: Basic Critical Zone Concepts	Sep. 23	Unit 2.2: Basic Critical Zone Concepts	
Sep. 28	Unit 3.1: Energy Budgets	Sep. 30	Unit 3.1: Energy Budgets	2-pg outline
Oct. 5	Unit 3.2: Carbon Budgets	Oct. 7	Unit 3.2: Carbon Budgets	
Oct. 12	Unit 4.1: Water Balance of a Tree	Oct. 14	Unit 4.1: Water Balance of a Tree	
Oct. 19	<i>No class</i>	Oct. 21	Unit 4.2: Water Balance Impacts	
Oct. 26	Unit 4.2: Water Balance Impacts	Oct. 28	Unit 5.1: Geomorphology	
Nov. 2	Unit 5.1: Geomorphology	Nov. 4	Unit 5.2: Landforms	
Nov. 9	Unit 5.2: Landforms	Nov. 11	Unit 6.1: Biogeochemical (BGC) Modeling framework	2 slides/2 min. update
Nov. 16	Unit 6.1: BGC Modeling framework	Nov. 18	Unit 6.2: BGC Examples	
Nov. 23	Unit 6.2: BGC Examples	Nov. 25	<i>No class</i>	
Nov. 30	Unit 7.1: Model My Watershed	Dec. 2	Unit 7.1: Model My Watershed	Final report/ Presentation
Dec. 7	Unit 7.2: Agricultural Impacts	Dec. 9	Unit 7.2: Agricultural Impacts	

Unit 1: CZ Background

Unit 2: Methods in CZ Science

Unit 3: Land-atmosphere exchange

Unit 4: Water transfer through the CZ

Unit 5: Landform and landscape evolution

Unit 6: Geochemistry and biogeochemistry

Unit 7: Humans in the CZ