Geology 160 – introduction to Geosystems

Units: 4 units

Fall Term 2024, 9-9:50 AM MWF

Location: Taper Hall of Humanities (THH) 301

Instructor: Steve P. Lund

Office: Zumberge Hall of Sciences (ZHS) 273

Office Hours: 10-11 AM MWF are my formal office hours. Actually, I am available any time. Come to my office (ZHS 273), call me (office: 213-740-5835; cell: 323-663-3620), or email me (slund@usc.edu) if you need a special meeting time.

Contact Info: slund@usc.edu

Course Description

This course introduces students to natural geological/environmental processes (systems) active at the Earth's surface. It will also assess the relationships between these physical processes and biological processes (ecosystems). This course will focus on the behavior of natural systems at a regional scale independent of human intervention; but it will identify key points where humans affect or are affected by the natural environment. Each topic should develop a systems level perspective that considers intrinsic interacting processes, their variability, and the potential for sustainability. The laboratory associated with the course employs a multi-media approach to illustrate the methods that Earth scientists use to develop an understanding of how the world's surface environments work. The long-term objective is that students can use this information to understand the environmental conditions wherever they might be in the World and have the science concepts (building blocks) necessary to understand their surroundings and explain what they see. They can also use the information from this course to evaluate legislative/policy issues that they may be called upon to vote on or decide upon.

Learning Objectives

This course describes and explains specific observable components of the World's surface environments and the organisms that live there. Each component (or building block, puzzle piece) can be combined with other components to explain more and more complicated aspects of surface Earth behavior. This hierarchical structure of combining science concepts (building blocks or puzzle pieces) to explain observed overall Earth behavior is called 'Earth System Science or Geosystems'. We use this approach in scientific research on all aspects of the Earth and to predict future planetary behavior. Tests will assess knowledge of individual specific components and evaluate whether students can combine simple components to describe more complicated aspects of the way surface Earth works.

Prerequisite(s): None. But a high-school understanding of basic science and mathematics is expected.

Course Notes

This is an in-person course. Required class material will be available on Brightspace (lecture PPTs, lab materials, grades). Students will need a computer with internet access to assess the course quizzes. Students must have access to a word processing program that will provide output as XXX.doc or XXX.pdf without linkage to a web browser.

Technological Proficiency and Hardware/Software Required

USC Computing Center Laptop Loaner Program, Zoom information for students, Brightspace help for students, Software available to USC Campus.]

Required Readings and Supplementary Materials

There are no required readings other than the PPT presentations associated with the lectures. Students learn in different ways. For students who want a textbook for this course, I recommend 'Earth Science' by Tarbuck and Lutgens, 14th ed. Pearson Publ. (I will provide an announcement on how to purchase the book before the start of class). (Elements of Ecology: Smith and Smith, 9th Ed., Pearson Publ. is a good extra reference for those with more significant biological interests.)

Description and Assessment of Assignments

The primary course assessment will be three 50-min in-person exams (multiple choice). Each exam will cover about 1/3 of the course. There will be short quizzes associated with each lecture. There will be nine laboratory activities plus two final PPT presentations (REAs – see below). There will be a final project/essay – Regional Ecosystem Assessments due the last day of class – Dec 6.

Participation

On-line quizzes (Brightspace) will follow each lecture. The quizzes can be taken any time after class until midnight of the class day. This is my means of taking attendance and making students stay up to date with the course material. The quizzes will be 4 questions on the day's lecture. The student will have 4 minutes to complete the quiz.

Grading Breakdown

Table 1 Grading Breakdown

Assessment Tool (assignments)	Points	% of Grade
3 50-min exams	50	50
Laboratory activities	30	30
Daily quizzes	10	10
Regional ecosystem assessments	10	10
TOTAL	100	100

Grading Scale

total grades will be assigned on a curve with ~1/3 A, ~1/3 B, and ~1/3 C. A total grade of 50% or better is required to pass the course and get a C. Students not completing quizzes and lab activities could end up with a score below 50% and receive a D/F. Students must pass the laboratory component to pass the course.

Course Schedule:

Week		Lecture	Book Chapters
1	Aug 26	01: Introduction: Earth as a Planet	EAR-1
1	Aug 28	02: Geosystems Approach to Studying the Earth	EAR-1
1	Aug 30	03: The Earth's Interior/Nature of Earth Materials	EAR-2,3
2	Sep 02	HOLIDAY	
2	Sep 04	04: Plate Tectonics/Mantle Convection	EAR-7,10
2	Sep 06	05: Plate Interactions I – earthquakes	EAR-8,10
3	Sep 09	06: Plate Interactions II – volcanism	EAR-9
3	Sep 11	07: Atmosphere Structure/Global Heat Budget	EAR-16
3	Sep 13	08: Atmospheric Circulation	EAR-17,18
4	Sep 16	09: Troposphere Weather	EAR-19

4	Sep 18	10: Space Weather		
4	Sep 20	11: Hydrosphere - Ocean Waves and Tides		EA-13,14
5	Sep 23	12: Surface Ocean Circulation I		EAR-14,15
5	Sep 25	13: Surface Ocean Circulation II		EAR-14,15
5	Sep 27	14: The Nature and Properties of Sea Water		EAR-14.15
6	Sep 30	15: Deep Ocean (Thermohaline) Circulation		EAR-14,15
6	Oct 02	**FIRST MIDTERM EXAM (Lectures 1-13)**		
6	Oct 04	16: Rock Cycle, Erosion, Weathering, Soil Formation		EAR-4
7	Oct 07	17: Hydrosphere - lakes, rivers, groundwater		EAR-5
7	Oct 09	18: Other terrestrial processes		EAR-5,6
7	Oct 11	HOLIDAY		
8	Oct 14	19: Cryosphere - Glaciers and Ice sheets		EAR-6
8	Oct 16	20: Climate System		EAR-20
8	Oct 18	21: Short- and Long-Term Climate Forcing		EAR-20
9	Oct 21	22: Climate – The Earth's Distant Past		EAR-20
9	Oct 23	23: Climate - The Last 100,000 Years		EAR-20
9	Oct 25	24: ENSO variability		
10	Oct 28	25 Global Warming		
10	Oct 30	**SECOND MIDTERM EXAM (Lectures 14-25)**		
10	Nov 01	26: Nutrient Cycles		
11	Nov 04	28: Overview of the Biosphere		EAR-14,
11	Nov 06	29: Ecosystem Dynamics I	EAR-14, EAR-20	
11	Nov 08	30: Ecosystem Dynamics II	EAR-14, EAR-20	
12	Nov 11	HOLIDAY		
12	Nov 13	31: Pelagic Ecosystems		EAR-14
12	Nov 15	32: Benthic Ecosystems and Anoxia		EAR-14
13	Nov 18	33: Coastal Processes/Ecosystems		EAR-14
13	Nov 20	34: Coral Reefs/ Mangrove Swamps		EAR-14
13	Nov 22	36: Tropical Rain Forests and Savannahs		EAR-20
14	Nov 25	37: Temperate Forests and Grasslands		EAR-20
14	Nov 27	THANKSGIVING HOLIDAY		
14	Nov 29	THANKSGIVING HOLIDAY		
15	Dec 02	38: Arctic/Tundra Ecosystems		EAR-20
15	Dec 04	39: Ecosystem Assessments		EAR-20
15	Dec 06	**<u>EITHER</u> THIRD MIDTERM EXAM (Lectures 26-39)**		

Finals Week (Dec. 16, 11 AM – 1 PM): **<u>OR</u> THIRD MIDTERM EXAM (Lectures 26-39)**

Regional Ecosystem Assessments (REA)

Each student will write two short term papers, which are due on the last day of class (Dec 6). They will count for 10% of the total class grade. Each paper will be a regional ecosystem assessment (REA) for some specified location on the Earth's surface. One REA will be for a marine location and the other REA for a terrestrial location. Each term paper will have at least 4 pages of text (double- spaced), at least 3 extra pages of relevant figures, and a list of references (standard references and web-based resources). (All term papers need to be in electronic format – X.DOC or X.PDF). Each student will make two 5-minute Powerpoint presentations on these REAs during the last two laboratory periods for the course (one lab session will focus on marine REAs and the second on terrestrial REAs). Lab points will be given for the quality and content of the presentations.

Each REA will summarize the current environmental conditions, as discussed in this course, at each location and the primary organisms that live there. Key questions to answer are: 1) what are the most important environmental factors that control the ecosystem, 2) what aspects of the environment are variable (and on what time scales), 3) what are the most distinctive species in the ecosystem, 4) are there keystone species, 5) is there evidence for selected species population variability beyond a seasonal scale? Two additional

questions to consider are 1) how might the ecosystem change in the next 100 years with global warming and 2) are humans playing an important role in ecosystem stability now or in the future?

Each person will be given at set of geographic coordinates for each REA. Consider this 'location' to be at the center of the ecosystem under consideration, but the actual ecosystem might extend significantly beyond that location. I will try to focus on places that are 'special' in the sense that they have been previously studied more than the average random location on Earth. They may be regions where human activity is located or where humans significantly interact with their environment (coastal fisheries, for example); they may also be 'National Parks' for various countries. The point of preferentially using such REAs is that more has been published on these ecosystems. Inevitably, some people will get locations for which almost nothing is known. In such cases, use your general understanding gained from this class and reading to provide as much baseline-understanding for the REA as is possible.

Academic Integrity

The University of Southern California is foremost a learning community committed to fostering successful scholars and researchers dedicated to the pursuit of knowledge and the transmission of ideas. Academic misconduct is in contrast to the university's mission to educate students through a broad array of first-rank academic, professional, and extracurricular programs and includes any act of dishonesty in the submission of academic work (either in draft or final form).

This course will follow the expectations for academic integrity as stated in the USC Student Handbook. All students are expected to submit assignments that are original work and prepared specifically for the course/section in this academic term. You may not submit work written by others or "recycle" work prepared for other courses without obtaining written permission from the instructor(s). Students suspected of engaging in academic misconduct will be reported to the Office of Academic Integrity.

Other violations of academic misconduct include, but are not limited to, cheating, plagiarism, fabrication (e.g., falsifying data), knowingly assisting others in acts of academic dishonesty, and any act that gains or is intended to gain an unfair academic advantage.

Academic dishonesty has a far-reaching impact and is considered a serious offense against the university. Violations will result in a grade penalty, such as a failing grade on the assignment or in the course, and disciplinary action from the university itself, such as suspension or even expulsion.

For more information about academic integrity see the student handbook or the Office of Academic Integrity's website, and university policies on Research and Scholarship Misconduct.

Please ask your instructor if you are unsure what constitutes unauthorized assistance on an exam or assignment or what information requires citation and/or attribution.

Statement on University Academic and Support Systems

Students and Disability Accommodations:

USC welcomes students with disabilities into all of the University's educational programs. The Office of Student Accessibility Services (OSAS) is responsible for the determination of appropriate accommodations for students who encounter disability-related barriers. Once a student has completed the OSAS process (registration, initial appointment, and submitted documentation) and accommodations are determined to be reasonable and appropriate, a Letter of Accommodation (LOA) will be available to generate for each course. The LOA must be given to each course instructor by the student and followed up with a discussion. This should be done as early in the semester as possible as accommodations are not retroactive. More

information can be found at osas.usc.edu. You may contact OSAS at (213) 740-0776 or via email at osasfrontdesk@usc.edu.

Student Financial Aid and Satisfactory Academic Progress:
To be eligible for certain kinds of financial aid, students are required to maintain Satisfactory Academic Progress (SAP) toward their degree objectives. Visit the Financial Aid Office webpage for undergraduate- and graduate-level SAP eligibility requirements and the appeals process.

Support Systems:
Counseling and Mental Health - (213) 740-9355 – 24/7 on call
Free and confidential mental health treatment for students, including short-term psychotherapy, group counseling, stress fitness workshops, and crisis intervention.

988 Suicide and Crisis Lifeline - 988 for both calls and text messages – 24/7 on call
The 988 Suicide and Crisis Lifeline (formerly known as the National Suicide Prevention Lifeline) provides free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a week, across the United States. The Lifeline consists of a national network of over 200 local crisis centers, combining custom local care and resources with national standards and best practices. The new, shorter phone number makes it easier for people to remember and access mental health crisis services (though the previous 1 (800) 273-8255 number will continue to function indefinitely) and represents a continued commitment to those in crisis.

Relationship and Sexual Violence Prevention Services (RSVP) - (213) 740-9355(WELL) – 24/7 on call
Free and confidential therapy services, workshops, and training for situations related to gender- and power-based harm (including sexual assault, intimate partner violence, and stalking).

Office for Equity, Equal Opportunity, and Title IX (EEO-TIX) - (213) 740-5086
Information about how to get help or help someone affected by harassment or discrimination, rights of protected classes, reporting options, and additional resources for students, faculty, staff, visitors, and applicants.

Reporting Incidents of Bias or Harassment - (213) 740-2500
Avenue to report incidents of bias, hate crimes, and microaggressions to the Office for Equity, Equal Opportunity, and Title for appropriate investigation, supportive measures, and response.

The Office of Student Accessibility Services (OSAS) - (213) 740-0776
OSAS ensures equal access for students with disabilities through providing academic accommodations and auxiliary aids in accordance with federal laws and university policy.

USC Campus Support and Intervention - (213) 740-0411
Assists students and families in resolving complex personal, financial, and academic issues adversely affecting their success as a student.

Diversity, Equity and Inclusion - (213) 740-2101
Information on events, programs and training, the Provost's Diversity and Inclusion Council, Diversity Liaisons for each academic school, chronology, participation, and various resources for students.

USC Emergency - UPC: (213) 740-4321, HSC: (323) 442-1000 – 24/7 on call
Emergency assistance and avenue to report a crime. Latest updates regarding safety, including ways in which instruction will be continued if an officially declared emergency makes travel to campus infeasible.

USC Department of Public Safety - UPC: (213) 740-6000, HSC: (323) 442-1200 – 24/7 on call
Non-emergency assistance or information.

Office of the Ombuds - (213) 821-9556 (UPC) / (323-442-0382 (HSC)
A safe and confidential place to share your USC-related issues with a University Ombuds who will work with you to explore options or paths to manage your concern.

Occupational Therapy Faculty Practice - (323) 442-2850 or otfp@med.usc.edu
Confidential Lifestyle Redesign services for USC students to support health promoting habits and routines that enhance quality of life and academic performance.