

## **Term Information**

Effective Term Spring 2021

## **General Information**

Course Bulletin Listing/Subject Area Earth Sciences  
Fiscal Unit/Academic Org School of Earth Sciences - D0656  
College/Academic Group Arts and Sciences  
Level/Career Graduate, Undergraduate  
Course Number/Catalog 5268  
Course Title Soils and Climate Change  
Transcript Abbreviation Soils and Climate  
Course Description Soil processes, abrupt climate change, trace gases and their properties, global C cycle, gaseous emissions, C-neutral fuels, carbon sequestration, Kyoto Treaty, trading of C credits.  
Semester Credit Hours/Units Fixed: 3

## **Offering Information**

Length Of Course 14 Week, 12 Week, 8 Week, 7 Week, 6 Week, 4 Week  
Flexibly Scheduled Course Never  
Does any section of this course have a distance education component? No  
Grading Basis Letter Grade  
Repeatable No  
Course Components Lecture  
Grade Roster Component Lecture  
Credit Available by Exam No  
Admission Condition Course No  
Off Campus Never  
Campus of Offering Columbus

## **Prerequisites and Exclusions**

Prerequisites/Corequisites  
Exclusions Not open to students with credit for ENR 5268  
Electronically Enforced Yes

## **Cross-Listings**

Cross-Listings Cross-listed in ENR

## **Subject/CIP Code**

Subject/CIP Code 01.1201  
Subsidy Level Doctoral Course  
Intended Rank Senior, Masters, Doctoral, Professional

## Requirement/Elective Designation

The course is an elective (for this or other units) or is a service course for other units

## Course Details

### Course goals or learning objectives/outcomes

- Understand historic and abrupt climate change.  
Understand human perturbations of the global carbon cycle.  
Understand strategies of carbon sequestration, carbon-neutral biofuels, ecosystem services, and carbon trading.

### Content Topic List

- Soil processes
- Past and abrupt climate change
- Trace gases and their properties
- Short and long term historic carbon loss from the biosphere
- Global carbon cycles
- Gaseous emissions
- Carbon-neutral fuels
- Terrestrial and geologic carbon sequestration
- Kyoto treaty
- Trading of carbon credits

### Sought Concurrence

No

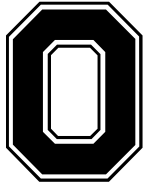
## Attachments

- ENR 5268 3CH Syllabus 2021.docx: syllabus  
*(Syllabus. Owner: Panero,Wendy R)*
- CURRICULAR MAP OF COURSES AVAILABLE IN EARTH SCIENCES B.docx: curriculum map  
*(Other Supporting Documentation. Owner: Panero,Wendy R)*

## Comments

## Workflow Information

Status	User(s)	Date/Time	Step
Submitted	Panero,Wendy R	02/25/2020 01:41 PM	Submitted for Approval
Approved	Panero,Wendy R	02/25/2020 01:42 PM	Unit Approval
Approved	Haddad,Deborah Moore	02/25/2020 02:10 PM	College Approval
Pending Approval	Jenkins,Mary Ellen Bigler Hanlin,Deborah Kay Oldroyd,Shelby Quinn Vankeerbergen,Bernadette Chantal	02/25/2020 02:10 PM	ASCCAO Approval



**THE OHIO STATE UNIVERSITY**

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**ENR/EARTHSC 5268  
SOILS AND CLIMATE CHANGE**

**Spring 2021  
Course Outline**

3 Credit Hours  
460 Kottman Hall  
Mondays and Wednesdays 2:20-3:40 pm

**Instructors:**

**Dr. R. Lal**

422B Kottman Hall

614-292-9069

Lal.1@osu.edu

**Dr. W.B. Lyons**

School of Earth Sciences, 275-D Mendenhall Lab

614-688-3241

lyons.142@osu.edu

carey.145@osu.edu

Office hours by appointment.

## PREREQUISITES

None.

## COURSE DESCRIPTION

Soil processes, abrupt climate change, trace gases and their properties, global C cycle, gaseous emissions, C-neutral fuels, carbon sequestration, Kyoto Treaty, trading of C credits.

## COURSE OBJECTIVES

This course is designed for students interested in learning basic soil and geologic processes as they impact climate change and are impacted by it. The syllabus meets the curriculum needs of students in Soil Sciences, Earth Sciences, Environmental Sciences, Natural Resources, Food, Agric. & Biol. Engineering, Horticulture and Crop Sciences, Forestry, Architecture, Landscaping, Civil Engineering, Environmental Engineering, Public Policy, and Agric. Economics.

## LEARNING OUTCOMES

After completion of this course, students will be able to:

1. Document soil and geological processes and address climate change issues.
2. Apply basic concepts to understand the following:
  - (i) Greenhouse effect, geologic climate changes, and abrupt climate change,
  - (ii) Global C cycle (global C cycle: geologic, current),
  - (iii) Gaseous emissions (CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O),
  - (iv) Biogeochemical cycles, coupled cycles of C, N, P, S and H<sub>2</sub>O,
  - (v) Carbon sequestration,
  - (vi) Terrestrial and geologic sequestration, processes,
3. Measurement of soil C pool and fluxes.
4. Soil Quality and C Sequestration.
5. Biofuels
6. Trading of C credits and the payments for ecosystem services
7. Climate Resolutions by UNFCCC Summit 21, 22, 25 and others
8. Evaluating C footprint of products and processes

## TEXTBOOKS

None. Readings will be made available on Carmen (<https://carmen.osu.edu>).

## COURSE TECHNOLOGY

For help with your password, university e-mail, Carmen, or any other technology issues, questions, or requests, contact the OSU IT Service Desk. Standard support hours are available at <https://ocio.osu.edu/help/hours>, and support for urgent issues is available 24x7.

- **Carmen Help:** <https://resourcecenter.odee.osu.edu/carmencanvas>

- **Self-Service and Chat support:** <http://ocio.osu.edu/selfservice>
- **Phone:** 614-688-HELP (4357)
- **Email:** [8help@osu.edu](mailto:8help@osu.edu)
- **TDD:** 614-688-8743

## GRADING

There are **3 homework sets** and **one seminar** by each student. Each of these is 25% of the grade. Thus, presentation of a seminar and participation in the discussion together are equal to one homework.

Homework #1: 25%

Homework #2: 25%

Homework #3: 25%

Seminar presentation and weekly discussion participation: 25%

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100%

## ASSIGNMENT DESCRIPTIONS

### Homework assignments

The three homework assignments will address the following course topics: a) Greenhouse effect vs. global warming, short term carbon cycle, Anthropocene and the carbon cycle, atmospheric chemistry, sources and sinks of carbon, and the role of soil in the carbon cycle. b) Paleoclimate, the long-term carbon cycle, silicate weathering, ocean circulation, fate of carbon transport with sediments. c) Adaptation vs. mitigation, geological vs. terrestrial sequestration, carbon trading, payments for ecosystem services, translating science into action.

Additional details on each homework assignment will be posted on Carmen.

### Seminar presentation and weekly discussion participation

The seminar presentation schedule will be prepared during the first week of the classes. At end of the weekly seminar presentation, each student is required to ask a question on the theme presented. Quality of the seminar and of the question are evaluated. Additional details on the presentations will be discussed during the first week of class and posted to Carmen.

## LATE WORK POLICY

Students are given two weeks time to complete and submit the homework. Late submission (by one week) is accepted for good reason (health, family situation, etc.). The student must present documentation and contact the instructor as soon as possible to discuss their situation.

## Grading scale

93–100: A

90–92.9: A-

87–89.9: B+

83–86.9: B

80–82.9: B-

77–79.9: C+

73–76.9: C

70 –72.9: C-  
67 –69.9: D+  
60 –66.9: D  
Below 60: E

**DIFFERENTIAL EXPECTATIONS FOR GRADUATE STUDENTS**

There are no different expectation for graduate students versus undergraduate students. All students are treated equally.

## ENR 5268 SOILS AND CLIMATE CHANGE

WEEK	DAY	TOPIC
1	M	Greenhouse Effect and the Global Carbon Cycle: Current (RL)
	W	Global Warming versus the Greenhouse Effect: Class Discussions (RL)
2	M	Global Carbon Cycle: Geologic (BL)
	W	Short-term versus Long-Term Carbon Cycle: Class Discussions (BL)
3	M	The Anthropocene (RL)
	W	Onset of the Anthropocene: Class Discussions (RL)
4	M	C Sequestration Strategies: Terrestrial Sequestration (RL)
	W	Pros and Cons of Different C Sequestration Options: Class Discussions (BL)
5	M	Past Climate Changes, Abrupt Climate Change (BL)
	W	Human Demands and Climate Change: Class Discussions (BL)
6	M	Land Use and Historic C Loss (RL) (Homework 1)
	W	Soil/Terrestrial Carbon Sequestration Potential: Class Discussions (RL)
7	M	Fossil Fuel Emissions and Geologic Sequestration (BL) (Homework 2)
	W	Fossil versus Renewable (Non-Carbon) Energy: Class Discussions (BL)
8	M	Soil Management and the Positive Ecosystem C Budget (RL)
	W	Low-C or No-Carbon Farming: Class Discussions (RL)
9	M	Soil Erosion and the Global Carbon Cycle (RL)
	W	Erosion as a Source or Sink of GHGs: Class Discussions (RL)
10	M	<b>Spring Break</b>
	W	<b>Spring Break</b>
11	M	Permafrost Soils and the Positive Feedback (RL) (Homework 3)
	W	Fate of C in Permafrost Ecosystems: Class Discussions (RL)
12	M	Fate and Transport of C in Aquatic Ecosystems (BL)
	W	Managing Aquatic Ecosystems as Sinks of C: Class Discussions (BL)
13	M	Biogeochemical Processes and the Global Carbon Cycle (BL)
	W	Humanity and the Carbon Cycle: Class Discussions (BL)
14	M	Managing Soil Carbon, Biofuels Feedstock, Biochar, and Trading Carbon (RL)
	W	Re-carbonization of the Terrestrial Biosphere: Class Discussions (RL)
15	M	Farming carbon (RL)
	W	Farming Carbon: Class Discussions (RL)
(RL) = Rattan Lal (BL) = Berry Lyons		

## OHIO STATE'S ACADEMIC INTEGRITY POLICY

Academic integrity is essential to maintaining an environment that fosters excellence in teaching, research, and other educational and scholarly activities. Thus, The Ohio State University and the Committee on Academic Misconduct (COAM) expect that all students have read and understand the University's *Code of Student Conduct*, and that all students will complete all academic and scholarly assignments with fairness and honesty. Students must recognize that failure to follow the rules and guidelines established in the University's *Code of Student Conduct* and this syllabus may constitute "Academic Misconduct."

The Ohio State University's *Code of Student Conduct* (Section 3335-23-04) defines academic misconduct as: "Any activity that tends to compromise the academic integrity of the University, or subvert the educational process." Examples of academic misconduct include (but are not limited to) plagiarism, collusion (unauthorized collaboration), copying the work of another student, and possession of unauthorized materials during an examination. Ignorance of the University's *Code of Student Conduct* is never considered an "excuse" for academic misconduct, so I recommend that you review the *Code of Student Conduct* and, specifically, the sections dealing with academic misconduct.

**If I suspect that a student has committed academic misconduct in this course, I am obligated by University Rules to report my suspicions to the Committee on Academic Misconduct.** If COAM determines that you have violated the University's *Code of Student Conduct* (i.e., committed academic misconduct), the sanctions for the misconduct could include a failing grade in this course and suspension or dismissal from the University.

If you have any questions about the above policy or what constitutes academic misconduct in this course, please contact me.

Other sources of information on academic misconduct (integrity) to which you can refer include:

- The Committee on Academic Misconduct web pages ([COAM Home](#))
- *Ten Suggestions for Preserving Academic Integrity* ([Ten Suggestions](#))
- *Eight Cardinal Rules of Academic Integrity* ([www.northwestern.edu/uacc/8cards.htm](http://www.northwestern.edu/uacc/8cards.htm))

## STATEMENT ON TITLE IX

Title IX makes it clear that violence and harassment based on sex and gender are Civil Rights offenses subject to the same kinds of accountability and the same kinds of support applied to offenses against other protected categories (e.g., race). If you or someone you know has been sexually harassed or assaulted, you may find the appropriate resources at <http://titleix.osu.edu> or by contacting the Ohio State Title IX Coordinator, Kellie Brennan, at [titleix@osu.edu](mailto:titleix@osu.edu)

## DIVERSITY AT OHIO STATE



The Ohio State University affirms the importance and value of diversity in the student body. Our programs and curricula reflect our multicultural society and global economy and seek to provide opportunities for students to learn more about persons who are different from them. We are committed to maintaining a community that recognizes and values the inherent worth and dignity of every person; fosters sensitivity, understanding, and mutual respect among each member of our community; and encourages each individual to strive to reach his or her own potential. Discrimination against any individual based upon protected status, which is defined as age, color, disability, gender identity or expression, national origin, race, religion, sex, sexual orientation, or veteran status, is prohibited.

## **YOUR MENTAL HEALTH**

As a student you may experience a range of issues that can cause barriers to learning, such as strained relationships, increased anxiety, alcohol/drug problems, feeling down, difficulty concentrating and/or lack of motivation. These mental health concerns or stressful events may lead to diminished academic performance or reduce a student's ability to participate in daily activities. The Ohio State University offers services to assist you with addressing these and other concerns you may be experiencing. If you or someone you know are suffering from any of the aforementioned conditions, you can learn more about the broad range of confidential mental health services available on campus via the Office of Student Life Counseling and Consultation Services (CCS) by visiting [ccs.osu.edu](http://ccs.osu.edu) or calling (614) 292- 5766. CCS is located on the 4th Floor of the Younkin Success Center and 10th Floor of Lincoln Tower. You can reach an on-call counselor when CCS is closed at (614) 292-5766 and 24 hour emergency help is also available through the 24/7 National Prevention Hotline at 1-(800)-273-TALK or at [suicidepreventionlifeline.org](http://suicidepreventionlifeline.org).

## **REQUESTING ACCOMODATIONS FOR STUDENTS WITH DISABILITIES**

The University strives to make all learning experiences as accessible as possible. If you anticipate or experience academic barriers based on your disability (including mental health, chronic or temporary medical conditions), please let me know immediately so that we can privately discuss options. To establish reasonable accommodations, I may request that you register with Student Life Disability Services. After registration, make arrangements with me as soon as possible to discuss your accommodations so that they may be implemented in a timely fashion. SLDS contact information: 614-292-3307; [slds.osu.edu](http://slds.osu.edu); 098 Baker Hall, 113 W. 12th Avenue.

**CURRICULAR MAP OF COURSES AVAILABLE IN EARTH SCIENCES B.S.**

Course Number	Course Title	PLO A: Read/ evaluate Earth Sci literature	PLO B: Present Earth Sci info	PLO C: Apply Earth Sci data	PLO D: Apply appropriate techniques/ methods	PLO E: Identify Earth Sci problems, develop solutions	PLO F: Apply other sciences	BS program required /elective
Earth Sciences 1100	Planet Earth: How it works	B	B	B	B	B	B	O-prep
Earth Sciences 1105	Geology of the National Parks	B	B	B		B	B	O-prep
Earth Sciences 1108	Gemstones	B	B	B		B	B	O-prep
Earth Sciences 1121	The Dynamic Earth	B	B	B	B	B	B	O-prep
Earth Sciences 1151	Natural Hazards	B	B	B	B	B	B	O-prep
Earth Sciences 2203	Environmental Geoscience	B	B	B		B	B	O-prep
Earth Sciences 2205	The Planets	B	B	B		B	B	O-prep O-PS
Earth Sciences 2206(&S)	Principles of Oceanography	B	B	B		B	B	O-prep O-SS
Earth Sciences 1200	Introductory Earth Science Lab		B	B	B	B	B	O-prep
Earth Sciences 2000	Preparation for Thesis and Careers in the Earth Sciences	B-I	B-I	B-I		B-I		R-GS R-GP R-CWE
Earth Sciences 2122	Climate and Life over Billions of years on Earth	B-I	B-I	B-I	B-I	B-I		O-SS R-GS
Earth Sciences 2155	Energy and Environment	B-I	B-I	B-I	B-I	B-I		O-SS
Earth Sciences 2203	Environmental Geoscience	B-I	B-I	B-I	B-I	B-I		O-SS
Earth Sciences 2204	Exploring Water Issues	B-I	B-I	B-I	B-I	B-I		O-SS
Earth Sciences 2210	Energy, Mineral Resources, and Society	B-I	B-I	B-I	B-I	B-I		O-SS
Earth Sciences 2212	Intro to Earth Materials	B-I	B-I	B-I	B-I	B-I		O-CWE
Earth Sciences 3411	Water Security for the 21 <sup>st</sup> Century	I	I	I	I	I		O-SS



Earth Sciences 5189.02	Field Geology II	A	A	A	A	A	A	R-GS O-PG
Earth Sciences 5191	Internship in the Earth Sciences	I - A	I - A	I - A	I - A	I - A	I - A	
Earth Sciences 5191.01	Museum Internship	A	A	A	A	A	A	
Earth Sciences 5193.xx	Individual Studies	I - A	I - A	I - A	I - A	I - A	I - A	
Earth Sciences 5194	Group Studies	I - A	I - A	I - A	I - A	I - A	I - A	
Earth Sciences 5203	Geo-environment and Human Health	A	A	A	A	A	A	O-CWE O-HG
Earth Sciences 5205	Planetary Science	A	A	A	A	A	A	R-PS
Earth Sciences 5206	Advanced Oceanography	A	A	A	A	A	A	R-MS O-CWE
Earth Sciences 5268	Soils and Climate Change	A	A	A	A	A	A	O-CWE O-HG
Earth Sciences 5501	Museum Databases	A	A	A	A	A	A	O-MC
Earth Sciences 5550	Geomorphology	I-A	I-A	I-A	I-A	I-A	I-A	O-PS O-HG
Earth Sciences 5600	Siliciclastic Depositional Systems	A	A	A	A	A	A	
Earth Sciences 5601.01	Sedimentary Petrology: Sandstones	A	A	A	A	A	A	
Earth Sciences 5601.02	Sedimentary Petrology: Carbonate Rocks and Shales	A	A	A	A	A	A	
Earth Sciences 5602.01	Carbonate Depositional Systems I	A	A	A	A	A	A	
Earth Sciences 5602.02	Carbonate Depositional Systems II	A	A	A	A	A	A	O-MS
Earth Sciences 5603	Stratigraphy	A	A	A	A	A	A	
Earth Sciences 5604	Sequence Stratigraphy	A	A	A	A	A	A	
Earth Sciences 5605	Paleoceano graphy	A	A	A	A	A	A	
Earth Sciences 5613	Micropaleon tology	A	A	A	A	A	A	
Earth Sciences 5614	Paleobiology	A	A	A	A	A	A	
Earth Sciences 5615	Paleoecology	A	A	A	A	A	A	

Earth Sciences 5617	Petrology of Earth and Planets	A	A	A	A	A	A	
Earth Sciences 5618	Advanced Historical Geology	A	A	A	A	A	A	
Earth Sciences 5621	Introduction to Geochemistry	A	A	A	A	A	A	O-CWE O-HG
Earth Sciences 5622	Stable Isotope Biogeochemistry	A	A	A	A	A	A	O-MS
Earth Sciences 5625	Igneous Petrology	A	A	A	A	A	A	
Earth Sciences 5627	Global Biogeochemical Cycles	A	A	A	A	A	A	
Earth Sciences 5628	Environmental Isotope Geochemistry	A	A	A	A	A	A	
Earth Sciences 5629	Principles of Petrology	A	A	A	A	A	A	
Earth Sciences 5636	Advanced Topics in Mineralogy and Crystallography	A	A	A	A	A	A	
Earth Sciences 5641	Geostatistics	A	A	A	A	A	A	O-GP
Earth Sciences 5642	Geomathematical Analysis	A	A	A	A	A	A	
Earth Sciences 5644	Tectonic Evolution of Continents	A	A	A	A	A	A	
Earth Sciences 5645	Advanced Structural Geology	A	A	A	A	A	A	
Earth Sciences 5646	Geodynamics	A	A	A	A	A	A	O-GP O-PS
Earth Sciences 5650	Glaciology	A	A	A	A	A	A	O-CWE
Earth Sciences 5651	Hydrogeology	A	A	A	A	A	A	O-CWE O-GP R-HG
Earth Sciences 5655	Land Surface Hydrology	A	A	A	A	A	A	O-CWE O-HG
Earth Sciences 5660	Geology of Metallic Deposits	A	A	A	A	A	A	
Earth Sciences 5661	Petroleum Geology	A	A	A	A	A	A	O-PG
Earth Sciences 5663	Global Change and Sustainability in the Earth System	A	A	A	A	A	A	O-SS
Earth Sciences 5670	General and Economic Geology of Selected Areas	A	A	A	A	A	A	

Earth Sciences 5676	Elemental Chemical Analysis using Inductively Coupled Plasma Optical Emission and Mass Spectrometry	A	A	A	A	A	A	
Earth Sciences 5680	Deep Earth Geophysics	A	A	A	A	A	A	O-GP O-PS
Earth Sciences 5687	Borehole Geophysics	A	A	A	A	A	A	O-GP O-PG
Earth Sciences 5703	Principles of Biostratigraphy	A	A	A	A	A	A	
Earth Sciences 5713	Taxonomy and Phylogeny in the Fossil Record	A	A	A	A	A	A	
Earth Sciences 5714	Biometry	A	A	A	A	A	A	
Earth Sciences 5717	Critical Issues in World Freshwater Resources	A	A	A	A	A	A	
Earth Sciences 5718	Aquatic Geochemistry	A	A	A	A	A	A	
Earth Sciences 5719	Environmental Organic Geochemistry	A	A	A	A	A	A	
Earth Sciences 5746	Seminar in Rheological Properties of Solids	A	A	A	A	A	A	
Earth Sciences 5751	Quantitative Ground-Water Flow Modeling	A	A	A	A	A	A	O-PG O-HG
Earth Sciences 5752	Contaminants in Aqueous Systems	A	A	A	A	A	A	
Earth Sciences 5754	Risk Assessment and Management in Earth Systems	A	A	A	A	A	A	
Earth Sciences 5779	Seminar in Physical Properties of Minerals and Rocks	A	A	A	A	A	A	
Earth Sciences 5780	Reflection Seismology	A	A	A	A	A	A	O-MS O-PG
Earth Sciences 5781	Gravity Exploration	A	A	A	A	A	A	
Earth Sciences 5782	Magnetic Exploration	A	A	A	A	A	A	
Geod Sci 5781	Geodesy and Geodynamics	A	A	A	A	A	A	O-GP O-PS
Electives from other departments (Geog, AtmosSC, EEOB, ENR, Chem, Math, etc.)							I-A	

Program Learning Goals:

- A) Students critically read and evaluate Earth Science literature
- B) Students present Earth Science information in a clear and logical manner, both orally and in writing.
- C) Students apply knowledge of Earth Science data to understand the dynamic physical, chemical, and biological processes of the Earth and its history.
- D) Students apply knowledge of appropriate techniques, field methods, field mapping, and numerical methods to measure, portray, analyze, and interpret Earth Science data in specific subdisciplines.
- E) Students identify Earth Science problems and develop solutions.
- F) Students apply knowledge of modern applications from chemistry, physics, biology, mathematics, statistics, and computing to the solution of Earth Science problems.

Key: B = Beginning level; I = Intermediate level; A = Advanced level

Program Course Listing:

- R- Required
- O - one of multiple option
- prep - preparation (all BS programs)
- SS – science of sustainability (all BS programs)
- GS – Geological Sciences subprogram
- CWE- Climate Water Environment subprogram
- GP- Geophysics subprogram
- MS – Marine Science certificate
- PS- Planetary Science certificate
- HG- Hydrogeology certificate
- MC – Museum Curation certificate
- PG- Petroleum Geology certificate