Term Information

Effective Term	Summer 2023
Previous Value	*Autumn 2021*

Course Change Information

What change is being proposed? (If more than one, what changes are being proposed?)

Inclusion in the new GE as a course in the (1) Sustainability and (2) Health & Well-being Themes

What is the rationale for the proposed change(s)?

This existing Earth Science course is a natural fit as a 2000-level course in the new GE Themes Sustainability and Health & Well-being and has been updated to highlight how it fulfills the ELOs of both Themes.

What are the programmatic implications of the proposed change(s)?

(e.g. program requirements to be added or removed, changes to be made in available resources, effect on other programs that use the course)?

None.

Is approval of the requrest contingent upon the approval of other course or curricular program request? No

Is this a request to withdraw the course? No

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	Undergraduate
Course Number/Catalog	2203
Course Title	Environmental Geoscience
Transcript Abbreviation	Envirnmntal Geosci
Course Description	Concepts and challenges of geological hazards and resources, environmental pollution, and health; regional and long-range planning; and global change and sustainability.
Previous Value	*Concepts and challenges of geological hazards and resources, environmental pollution, and health; regional and long-range planning; and global change and sustainability. Autumn 2021 and after: Add EarthSc 1200 for Physical Science GE lab credit.*
Semester Credit Hours/Units	Fixed: 3

Offering Information

Length Of Course	14 Week, 12 Week, 8 Week, 7 Week, 6 Week
Flexibly Scheduled Course	Sometimes
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, Lima, Mansfield, Marion, Newark, Wooster

Previous Value *Columbus, Lima, Mansfield, Marion, Newark*

Prerequisites and Exclusions

Prerequisites/Corequisites

Exclusions

Electronically Enforced No

Cross-Listings

Cross-Listings

Subject/CIP Code

Subject/CIP Code 40.0601
Subsidy Level Baccalaureate Course
Intended Rank Freshman, Sophomore, Junior, Senior

Requirement/Elective Designation

Required for this unit's degrees, majors, and/or minors
General Education course:
Physical Science; Health and Well-being; Sustainability
The course is an elective (for this or other units) or is a service course for other units

Previous Value

Required for this unit's degrees, majors, and/or minors
General Education course:
Physical Science
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

- Introduce and apply basic concepts of Earth Science in understanding complex Earth Science issues including resource development and utilization, geologic hazards and global change;
- and in responding in meaningful ways to these challenges in the area of sustainability and the health and well-being of all people living on our planet.

Previous Value

- *An introduction to environmental geoscience*

Content Topic List

- Environmental geoscience and the earth system
- Ecological principles and concepts
- Geologic hazards: processes, losses, mitigation
- Flood, mass movement, coastal, volcanic, and earthquake hazards
- Water resources and waste management
- Environmental health, ground water contamination
- Global change and sustainability
- Site, regional, and long-range planning
- Mineral and energy resources
- Scenarios for sustainability

Sought Concurrence No

Attachments

- EARTHSC2203 syllabus.docx: updated syllabus

  (Syllabus. Owner: Griffith,Elizabeth M)

- submission-sustainability.pdf: application for Sustainability Theme

  (Other Supporting Documentation. Owner: Griffith,Elizabeth M)

- submission-health-well-being.pdf: application for Health & Well-being Theme

  (Other Supporting Documentation. Owner: Griffith,Elizabeth M)

Comments

- Sorry about that! *(by Griffith,Elizabeth M on 10/13/2022 06:46 PM)*
- Please select a term beyond SP23 since those requests were supposed to reach the Registrar's Office by Sept 1. Please select SU2013 or beyond. Thanks. *(by Vankeerbergen,Bernadette Chantal on 10/13/2022 02:19 PM)*

Workflow Information

Status	User(s)	Date/Time	Step
Submitted	Griffith,Elizabeth M	10/13/2022 02:14 PM	Submitted for Approval
Approved	Griffith,Elizabeth M	10/13/2022 02:14 PM	Unit Approval
Revision Requested	Vankeerbergen,Bernadette Chantal	10/13/2022 04:55 PM	College Approval
Submitted	Griffith,Elizabeth M	10/13/2022 06:46 PM	Submitted for Approval
Approved	Griffith,Elizabeth M	10/13/2022 06:47 PM	Unit Approval
Approved	Vankeerbergen,Bernadette Chantal	10/31/2022 02:04 PM	College Approval
Pending Approval	Cody,Emily Kathryn Jenkins,Mary Ellen Bigler Hanlin,Deborah Kay Hilty,Michael Vankeerbergen,Bernadette Chantal Steele,Rachel Lea	10/31/2022 02:04 PM	ASCCAO Approval

Earth Sciences 2203
Environmental Geoscience

Spring 2023 - The Ohio State University - 3 credits

Time and Place
Two 80-minute classes per week (Tuesdays and Thursdays)
Location: TBD

Instructor: Prof. David R. Cole
Email: cole.618@osu.edu
Phone: (614) 688-7407
Office: 305 Mendenhall Laboratory
Office Hours: By appointment

Catalog Course Description: Concepts and challenges of geological hazards and resources, environmental pollution, and health; regional and long-range planning; and global change and sustainability.

Course Rationale

As the world's population grows and expands, humans are placing a greater demand on Earth's resources and its sustainability, increasing the volume and extent of environmental pollution, encountering natural hazards more frequently, and causing a rapid change in the world's climate. College-educated consumers, voters, and decision-makers need to understand the frequency, magnitude and scope of these changes and the limitations that science and technology have in reducing their negative effects and improving societal resiliency to adapt. Studying environmental geoscience provides a valuable perspective for understanding potential strategies for a more sustainable world.

This course offers an in-depth survey of a broad range of topics that foster an understanding of the physical structure of the Earth, the processes that have formed our planet, and some of the key concerns and questions surrounding resource development and utilization. The topics covered include Earth processes, various associated natural hazards and their influence on Earth materials (for example rocks, soils, fluids), and life in ways that either affect or control humankind's environment. The focus of this course is on the intersection of four key concepts in environmental geoscience that include sustainability, human population growth, linked earth systems, and their impact on justice, equity, diversity and inclusion (JEDI) for the health and well-being of all people living on our planet.

Course Objective

This course will introduce and apply basic concepts of Earth Science (including Earth materials, Earth processes and Earth's history) in understanding complex Earth Science issues including resource development and utilization, geologic hazards and global change; and in responding in

meaningful ways to these challenges in the area of **sustainability** and the **health and well-being** of all people living on our planet.

As part of the **Sustainability** Theme of the General Education curriculum, this course is designed to prepare students to be able to do the following (ELO=Expected Learning Outcome):

General Theme **GOAL 1**: Successful students will analyze an important topic or idea at a more advanced and in-depth level than the foundations.

ELO 1.1 Engage in critical and logical thinking (about the topic or idea of the theme).

ELO 1.2 Engage in an advanced, in-depth, scholarly exploration of the topic or idea of the theme.

General Theme **GOAL 2**: Successful students will integrate approaches to the theme by making connections to out-of-classroom experiences with academic knowledge or across disciplines and/or to work they have done in previous classes and that they anticipate doing in future.

ELO 2.1 Identify, describe, and synthesize approaches or experiences (as they apply to the theme).

ELO 2.2 Demonstrate a developing sense of self as a learner through reflection, self-assessment, and creative work, building on prior experiences to respond to new and challenging contexts.

Sustainability Theme GOAL 3: Students analyze and explain how social and natural systems function, interact, and evolve over time; how human wellbeing depends on these interactions; how actions have impacts on subsequent generations and societies globally; and how human values, behaviors, and institutions impact multi-faceted, potential solutions across time.

ELO 3.1 Describe elements of the fundamental dependence of humans on Earth and environmental systems and on the resilience of these systems.

ELO 3.2 Describe, analyze and critique the roles and impacts of human activity and technology on both human society and the natural world, in the past, currently, and in the future.

ELO 3.3 Devise informed and meaningful responses to problems and arguments in the area of sustainability based on the interpretation of appropriate evidence and an explicit statement of values.

As part of the **Health and Well-being** Theme of the General Education curriculum, this course is designed to prepare students to be able to do the following:

General Theme **GOAL 1**: Successful students will analyze an important topic or idea at a more advanced and in-depth level than the foundations.

ELO 1.1 Engage in critical and logical thinking (about the topic or idea of the theme).

ELO 1.2 Engage in an advanced, in-depth, scholarly exploration of the topic or idea of the theme.

General Theme **GOAL 2**: Successful students will integrate approaches to the theme by making connections to out-of-classroom experiences with academic knowledge or across disciplines and/or to work they have done in previous classes and that they anticipate doing in future.

ELO 2.1 Identify, describe, and synthesize approaches or experiences (as they apply to the theme).

ELO 2.2 Demonstrate a developing sense of self as a learner through reflection, self-assessment, and creative work, building on prior experiences to respond to new and challenging contexts.

Health and Well-being Theme GOAL 3: Students will explore and analyze health and wellbeing through attention to at least two dimensions of wellbeing. (Ex: physical, mental, emotional, career, environmental, spiritual, intellectual, creative, financial, etc.).

ELO 3.1 Explore and analyze health and wellbeing from theoretical, socio-economic, scientific, historical, cultural, technological, policy, and/or personal perspectives.

ELO 3.2 Identify, reflect on, or apply strategies for promoting health and well-being.

We will achieve these goals (and associated ELOs) by studying a wide variety of Earth systems and Earth processes that affect humankind – the sustainability of human populations and their health and well-being. In turn, we explore how humans have impacted Earth (and its health and well-being) leading to negative effects to our environment such as water and land use, pollution, and climate change. Four intersecting key concepts are integrated into lectures – sustainability, human populations, linked Earth systems, and justice, equity, diversity, and inclusion (JEDI). The evolution of the Earth as a system is detailed both from a geological perspective as well as a historic one in terms of how technological advances over time have been beneficial to humans but have also been detrimental to our environment and its health and well-being. Students in the course are provided detailed overviews of timely environmental outcomes based on current research to understand the frequency, magnitude and scope of these changes and the limitations that science and technology have in reducing their negative effects and improving societal adaptation. Group research presentations challenge the students to identify and describe a key environmental issue in the context of the four overarching concepts the course emphasizes.

Earth Sciences Course Specific Expected Learning Outcomes

Upon successful completion of the course, students will:

- Understand the theory of plate tectonics as related to natural hazards and Earth resources;
- Describe common Earth materials and their relationship to environmental hazards;
- Explain how Earth processes create hazards to life and property;
- Describe the formation and distribution of earth resources and significant environmental effects (e.g., socio-economic, health) caused by their extraction, processing, and use;
- Describe and explain the hydrologic cycle and major sources of water, soil, and sediment pollution and methods for their management;
- Explain the causes and effects of global climate change, and its impact of sustainable resources, population growth, and societal infrastructure;
- Understand and apply four overarching concepts throughout the course where relevant - sustainability, human population growth, linked earth systems, hazardous Earth processes and their impacts on justice, equity, diversity and inclusion (JEDI).

Textbook

Introduction to Environmental Geology, 5th edition (2011)
Edward A. Keller
Published by Prentice Hall ISBN 978-0-321-72751-0

This is textbook provides much of the background necessary to understand the fundamental concepts of environmental geology in order to apply these concepts in the context of the natural world with real-world examples that investigate the complex interactions in our Earth system. These concepts unify the diverse topics covered in the course.

Instructional Methodology

This course will be taught in a lecture/discussion format illustrated with PowerPoint presentations which can contain videos, maps, diagrams, digital photographs, and content from relevant Web sites. Student learning will be assessed with in-class scheduled quizzes, pop-quizzes (unannounced), in-class group presentations, and assigned exercises. Lectures will be posted on Carmen.

Course Grade

The final course grade will be calculated based on total points as follows:

Lecture quizzes (5)	100 points (55% of your final grade)
Pop quizzes (variable)	10 points (5% of your final grade)
Assignments (3)	40 points (22% of your final grade)
Group research project	32 points (28% of your final grade)

TOTAL 182 points / 180 = % to calculate your final grade

All quizzes will be performed in-class. Each scheduled quiz will be taken twice on the same day. For scheduled quizzes, the first time the quiz is taken independently without notes (students will not be permitted to receive assistance or take the quiz as part of a group). Students will then re-take the quiz with notes and discussion among students will be permitted. The overall grade for a student for each quiz will consist of 70% from the first take (independent), and 30% from the second take (with assistance). Pop quizzes will be taken with no notes. Questions will be a mixture of multiple choice, true/false, and short answers. There is no cumulative final exam.

In-class Group Presentation

The class will be split the class into teams of 4-5 students. Each team will be expected to present a 12–15-minute talk on a particular topic that falls under 'Environmental Geoscience'. This may include topics such as specific natural disasters (e.g., Indonesian Tsunami of 2005, San Francisco Earthquake of 1989) or more general topics. The instructor will provide more details in class, including the group breakdowns, ideas for presentation topics, and rubric for grading.

Assignments (three)

Assignment 1 – What is your carbon footprint? (10 points) (assigned during Lecture 9)

This exercise challenges each student to calculate their carbon footprint assuming they commute to campus 15 miles one way every weekday over two semesters (assume 140 days total) using two different kinds of vehicles. One is a Porche 911 – 14 miles per gallon High Octane at $5/gallon, the second – a Honda Civic – 40 miles per gallon, regular gas at $4/gallon. In addition to calculating the total cost, the student is given the carbon density of each gas type, and once they have estimated the total carbon from use of each vehicle, then convert this to CO_2 equivalent and compare against the average monthly emissions from a coal and gas fire power plants, data provide by the instructor.

Assignment 2 – Sustainable energy usage (15 points) (assigned during Lecture 16)

The students quantitatively evaluate what kind of light bulb makes the most energy and financial sense, or if the choice does not really matter. Three types are identified – traditional incandescent, compact fluorescent and LED. Some factors that they need to be considered: How much does each bulb cost? How often do you need to replace a bulb, how much electricity does each kind use? How much of a cost savings is significant enough? The instructor provides an information sheet that describes the properties of each bulb – e.g., how long each one lasts, wattage, cost, etc. They have 5 lamps throughout their dorm/apartment. Each lamp uses 1 bulb. They must consider using all 5 lamps/per bulb type for an average of 6 hours per day, every day over a 4-year degree period.

Assignment 3 – Sinking cities, rising sea level (15 points) (assigned during Lecture 19)

Using an article titled "Sinking Cities – An Integrated Approach Toward Solutions" produced by the Deltares – Taskforce Subsidence group in The Netherlands, students are asked to quantitatively compare and contrast the effects of groundwater withdrawal on subsidence versus rising sea level for a set of coastal cities (e.g., New Orleans, Jakarta, Bangkok). The student output will include the answers to a series of essay-like questions plus a data table where they must calculate the relative contributions of sinking associated with groundwater withdrawal induced land subsidence and global sea level rise.

Academic Misconduct

Academic integrity is essential to maintaining an environment that fosters excellence in teaching, research, and other educational and scholarly activities. Thus, 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. For additional information, see the Code of Student Conduct (http://studentconduct.osu.edu (Links to an external site.)).

Students with Disabilities

The University strives to make all learning experiences as accessible as possible. If you anticipate or experience academic barriers based on a 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 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: slds@osu.edu; 614-292-3307; slds.osu.edu (Links to an external site.); 098 Baker Hall, 113 W. 12th Avenue.

Wellness & Mental Health

As a student, you or someone you know may experience a range of issues that may cause barriers to learning, may lead to diminished academic performance or may reduce a student's ability to participate in daily activities, such as strained relationships, increased anxiety, alcohol or drug problems, feeling down, difficulty concentrating and/or lack of motivation. Ohio State University offers services for students to assist with addressing these concerns. You can learn more about the range of services available on campus via the Office of Student Life Counseling and Consultation Services (CCS) by visiting 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 available through the 24/7 National Suicide Prevention Hotline at 1-800-273-TALK or suicidepreventionlifeline.org.

Diversity Statement

As your instructor in this course, I strongly support OSU's general commitment to diversity:

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.

If you experience any lack of respect in this context either by myself or any of your fellow students, please do not hesitate to reach out to me (by Carmen email) or a neutral party (e.g. the Office of Diversity and Inclusion: odi@osu.edu). Also, if you have a name and/or set of pronouns that differ from those apparent to me on Carmen, please let me know!

Other

For periodic announcements to the entire class, I will send a mass email to all students via Carmen. I will use your **OSU email account** for this purpose. I realize that many of you have other email accounts through services such as Goggle, Yahoo, or Hotmail. You must remember to check your OSU email account, or you may miss important announcements such as a change in Lecture topic or my absence due to sickness or unscheduled travel (e.g., family emergency).

Course Schedule & Outline

Part 1: Key Concepts, Our Earth, and Its Natural Hazards

Lecture 1: Introduction and Key Concepts (book chapter 1)
Overview of four key concepts of environmental geoscience – sustainability, human population, linked earth systems and justice, equity, diversity, and inclusion. Define sustainability with examples of sustainable systems, human population growth, examples of linked Earth systems (e.g., atmosphere-hydrosphere-geosphere); example of environmental impact on an impoverished population – Haiti – earthquake and then hurricane.

Lecture 2: Evolution of Earth (book chapter 2)
Historical overview of science and technology to date the Earth; background on atoms and radioactivity leading to different isotope systems used to date past earth events; quick summary of earth history covering 4.5 billion years, discuss the importance to be able to date events in order to assess the frequency of events that affect people.

Lecture 3: Structure and Plate Tectonics (book chapter 3)
Summary of the layers that make up the Earth; seismic monitoring technology that helped us identify the layers; the existence of Earth's tectonic plates and their motion over time; how Earth hazards – namely earthquakes and volcanoes - correlate with plate boundaries; how people's health and well-being are affected by where they live with respect to the plates.

Lecture 4: Overview of Natural Hazards (book chapter 5)
Overview that sets the stage for the detailed lectures to follow on specific natural hazards (e.g., earthquakes, volcanoes), introduce risk assessment strategy to understand Frequency, Magnitude and Scope (or Area) of a particular hazard. How hazards impact infrastructure, near- and far term sustainability, and recovery.

Quiz 1 – Lectures 1-4

Part 2: Dynamic Earth and Its Impacts

Lecture 5: Earthquakes (book chapter 6)
In this lecture we explore several questions - What processes are responsible for earthquakes? faults? Whereabouts are earthquakes most prevalent? How do earthquakes cause damage? shock waves? What other damage do earthquakes cause? How does human activity affect earthquakes? How do earthquakes affect disadvantaged populations and their health & well-being and sustainability of human populations in these areas?

Lecture 6: Tsunamis (book chapter 7)
Explains how tsunamis are a good example of linked Earth systems – the geosphere (earthquakes, landslides, volcanoes) and the hydrosphere (oceans, rivers). Frequency may be low, but magnitude and scope of their affect can be regional and even global; Discuss the impact on coastal populations and their infrastructure – e.g., fishing, agriculture, water supply, tourism; Importance of ocean monitoring.

Lecture 7: Volcanoes (book chapter 8)
Overview of what are magma and lava, volcano types and how global occurrences are linked to plate tectonics. Describe how hazards associated with eruptions can be local, regional, and global (e.g., ash cloud cooling earth, disruption to air travel), and the cost to economics at various scales.

Lecture 8: Oceans and Coastal Processes (book chapter 11)
Discussion focuses on: Waves and their characteristics; Erosion on vulnerable coast lines and the effect on human populations and their infrastructure and economy; Cyclone formation and movement; Nutrient upwelling in coastal regions and the importance of photosynthesis on forming the base of the ocean's food web via phytoplankton, how these regions affect coastal communities in both a positive (e.g., fisheries) and negative way (e.g., toxic 'red tides').

Quiz 2 – Lectures 5-8

Part 3: Water – Sources, Problems and Sustainability

Lecture 9: Rivers and Flooding (book chapter 9)
Discussion topics focus on: Introduces the hydrologic cycle with emphasis on different types of rivers, with different cross-sectional profiles; These profiles have implications for sediment transport and erosion; Varied land use can lead to changes in river profile and affect frequency of floods; Floods can occur rapidly (flash floods) or over time (downstream floods); Channel restoration can improve wetland sustainability, increase biodiversity, and reduce erosion.

Lecture 10: Drought with Examples (book chapter 13)
Introduces the use of U.S. drought maps to illustrate the historical variability of droughts affecting different regions across many decades (e.g., the Dust Bowl of the 1930s); delves into the severe drought out west, especially California in 2014-2015 and more recently, 2020-2021; details the economic impact particularly to agriculture (Central Valley of the California supplies nearly 30% of our U.S. produce) and tourism (low lake levels in major reservoirs associated with large dams fed by the Colorado River (e.g., Lake Powel, Lake Mead). Outlines sustainable strategies for dealing with drought.

Lecture 11: Groundwater Resources (book chapter 13)
Outlines several interconnected topics including: Water properties (it is a unique molecule); U.S. resources and use (Who has (clean) water and who does not – a JEDI issue in part); Groundwater concepts (e.g., vadose zone, water table, draw down); Example of a regional aquifer under stress due to over use and climate change - Ogallala Aquifer; a revisiting of the California Drought – farm produce productivity impacts; the global deployment of desalination for sustainable agriculture, industry, and the health and well-being of communities.

Lecture 12: Water Pollution (book chapter 14)
Introduces what we mean by water pollution and the various types of pollutants (e.g., heavy metals, agriculture runoff – fertilizers, synthetic chemicals); the concept of point versus non-point sources; the importance of 'biochemical oxygen demand' on the health of water; microbial

communities that pose a health risk; the concept of eutrophication due to nutrient (P and N) inputs to lakes and streams; the global problem of poor quality water for disadvantaged people and the impact on their health and well-being.

Quiz 3 – Lectures 9-12

Group Presentations

Presentation Instructions and Planning

Groups 1 – 5 Presentations

Groups 6 – 10 Presentations

Part 4: Energy and Mineral Resources for a Sustainable Future

Lecture 13: Fossil Fuels – A Carbon World (book chapter 16)
This lecture covers several topics including: The importance of energy to our way of life; the general patterns of energy production and consumption in the United States and globally; who has energy resources and who does not (an import-export and JEDI discussion); the types of major fossil fuels, their extraction, and the environmental impacts associated with their development; alternatives to coal and oil; Some of the controversies surrounding fossil fuel development here in the US (e.g., pipelines, CO_2 emissions, acid rain); where does Ohio fit into a carbon-based world?

Lecture 14: Gas Shale Fracking – A Special Case
This overview emphasizes how extracting gas and oil from shales has changed our dependence on foreign sources making our economy more sustainable. How are hydrocarbon-bearing shale deposits formed? Where are they located in the U.S.? What is the hydraulic fracturing technology? Why does it need to be used for oil and gas recovery from shale formations? What the benefits and concerns associated with hydraulic fracturing (e.g., water use, air pollution, boom and bust economic cycle)?

Lecture 15: Renewable Energy – The New Paradigm (book chapter 16)
This lecture addresses the current energy transition to the use of renewable technologies which are detailed – wind, solar and hydroelectric. We also discuss nuclear and geothermal energy, and the development of biofuels. A summary is provided of the general patterns of renewable energy production and consumption in the U.S. and globally, who has these energy resources and who does not (also an import-export and JEDI discussion).

Lecture 16: Mineral Resources (book chapter 15)
This lecture explores - Why do we care about mineral resources? We summarize the different Classifications of metallic and non-metallic earth materials and their role in U.S. and global economy; their role in everyday lives, production and consumption in the U.S. and globally; abundances of mineral resources, where are they located, and how are they formed so we can develop better exploration models? Examples of uncommon locations for mineral resources (e.g.,

ocean floor); Environmental impacts of mining (e.g., water, pollution, health, example, rare earth element extraction in China – an environmental nightmare).

Quiz 4 – Lectures 13-16

Part 5: Carbon Cycle, Climate Change, and Impacts on DEI

Lecture 17: Global Carbon Cycle (book chapter 18)
This lecture provides an overview of - What are the key carbon reservoirs on Earth? How does carbon move between these reservoirs? How much carbon moves between these reservoirs under normal conditions? What are the residence times for carbon in each reservoir? Special focus is given to how additional CO_2 is added to the atmosphere via land use change and burning of fossil fuels (coal, oil, gas), and who are the major contributors to emissions (e.g., U.S. and China)

Lecture 18: Climate Change (book chapter 18)
A summary is presents on several key concepts and outcomes of climate change - Changes in the concentration of atmospheric gases and global temperatures HAVE happened in Earth's past and continue. The changes now "appear" to be much faster than the planet has previously experienced. The main driver of climate change is the combustion of fossil fuels – a positive forcing factor? Some human activities (e.g., generation of aerosols) may act as a negative forcing event; large volcanic eruptions are also a negative forcing factor. Effects of global climate change are being felt most strongly at Earth's poles, where high rates of ice melt are occurring. Impoverished peoples in certain region are being more adversely impacted by climate change than others (e.g., escalating heat index in areas bordering the equator).

Lecture 19: Climate Mitigation and Adaptation (book chapter 18)
This lecture explores the question – what we can do about climate change? Discussion centers on the scale over which we need to do this – personal choices, local, regional, state, country-based and the global 'community'. Sustained living strategies consider mitigation (e.g., geo-engineering like CO_2 subsurface storage), and adaptation (e.g., transition to renewables leading to net-zero carbon, improved agricultural practices). Students are presented with compare and contrast scenarios involving the 'haves' and the 'have nots' in the context of global geography, economics and culture.

Lecture 20: Impacts of Climate Change on Sustainability and JEDI
The effects of climate change on sustainable infrastructure and people are covered in this final lecture. Several topics of relevance include - global climate change and health, pathways for weather to affect health (e.g., extreme weather events – temperature and storms/floods that affect land use and people), impacts to drinking water supply (e.g., sea level rise and integrity of coastal freshwater reservoirs), air quality, food production and security, vector-borne diseases, and food and water borne disease. We integrate a conversation of how all these impact different types of people (the haves and have-nots) in profoundly different ways.

Quiz 5 – Lectures 17-20 (During Finals Week)

GE Theme course submission worksheet: Sustainability

Overview

Courses in the GE Themes aim to provide students with opportunities to explore big picture ideas and problems within the specific practice and expertise of a discipline or department. Although many Theme courses serve within disciplinary majors or minors, by requesting inclusion in the General Education, programs are committing to the incorporation of the goals of the focal theme and the success and participation of students from outside of their program.

Each category of the GE has specific learning goals and Expected Learning Outcomes (ELOs) that connect to the big picture goals of the program. ELOs describe the knowledge or skills students should have by the end of the course. Courses in the GE Themes must meet the ELOs common for **all** GE Themes and those specific to the Theme, in addition to any ELOs the instructor has developed specific to that course. All courses in the GE must indicate that they are part of the GE and include the Goals and ELOs of their GE category on their syllabus.

The prompts in this form elicit information about how this course meets the expectations of the GE Themes. The form will be reviewed by a group of content experts (the Theme Advisory) and by a group of curriculum experts (the Theme Panel), with the latter having responsibility for the ELOs and Goals common to all themes (those things that make a course appropriate for the GE Themes) and the former having responsibility for the ELOs and Goals specific to the topic of **this** Theme.

Briefly describe how this course connects to or exemplifies the concept of this Theme (Sustainability)

In a sentence or two, explain how this class "fits' within the focal Theme. This will help reviewers understand the intended frame of reference for the course-specific activities described below.

(enter text here)

This course familiarizes the students with a wide variety of Earth systems and processes that affect humankind – the sustainability of human populations and their health and well-being. In turn, we explore how humans have impacted Earth (and its health and well-being) leading to negative effects to our environment such as water and land use, pollution, and climate change. Four intersecting key concepts are integrated into each lecture – sustainability, human population, linked Earth systems, and justice, equity, diversity, and inclusion (JEDI). The evolution of the Earth as a system is detailed both from a geological perspective as well as a historic one in terms of how technological advances over time have been beneficial to humans but also detrimental to our environment and its health and well-being. Students in the course are provided detailed overviews of timely environmental outcomes based on current research they use to understand the frequency, magnitude and scope of these changes and the limitations that science and technology have in reducing their negative effects and improving societal adaptation. Group research presentations challenge the students to identify and describe a key environmental issue in the context of the four overarching concepts the course emphasizes.

Connect this course to the Goals and ELOs shared by *all* Themes

Below are the Goals and ELOs common to all Themes. In the accompanying table, for each ELO, describe the activities (discussions, readings, lectures, assignments) that provide opportunities for students to achieve those outcomes. The answer should be concise and use language accessible to colleagues outside of the submitting department or discipline. The specifics of the activities matter—listing "readings" without a reference to the topic of those readings will not allow the reviewers to understand how the ELO will be met. However, the panel evaluating the fit of the course to the Theme will review this form in conjunction with the syllabus, so if readings, lecture/discussion topics, or other specifics are provided on the syllabus, it is not necessary to reiterate them within this form. The ELOs are expected to vary in their "coverage" in terms of number of activities or emphasis within the course. Examples from successful courses are shared on the next page.

Goal 1: Successful students will analyze an important topic or idea at a more advanced and in-depth level than the foundations. In this context, "advanced" refers to courses that are e.g., synthetic, rely on research or cutting-edge findings, or deeply engage with the subject matter, among other possibilities.

Goal 2: Successful students will integrate approaches to the theme by making connections to out-of-classroom experiences with academic knowledge or across disciplines and/or to work they have done in previous classes and that they anticipate doing in future.

	Course activities and assignments to meet these ELOs
ELO 1.1 Engage in critical and logical thinking.	This course has several learning objectives the students need to articulate: (1) Understand and apply four overarching concepts throughout the course where relevant - sustainability, population growth, linked earth systens, and their impacts on JEDI, (2) present the theory of plate tectonics as related to natural hazards and earth resources, (3) describe common earth materials and their relationship to environmental hazards; (4) explain how earth processes create hazards to life and property; (5) describe the occurrence and formation of earth resources and significant environmental effects caused by their extraction, processing, and use, (6) describe and explain the hydrologic cycle and major sources of water, soil, and sediment pollution and methods for their management, and (7) explain the causes and effects of global climate change, and its
ELO 1.2 Engage in an advanced, in-depth, scholarly exploration of the topic or ideas within this theme.	The students in this class are given three assignments that challenge their reasoning and analytical skills. This is in addition to the group research project they are required to do on a topic of their choosing within the broad landscape of environmental geosciences. Two of the three assignments center on energy utilization requiring some simple straightforward data analytic assessment. The third focuses on climate change. Energy and climate change topics were selected because they are most visible to the students, and most obviously, impactful on everyday life. Collectively, these assignments and the group project probe the students' ability to demonstrate an understanding of one or more of the key concepts covered in the class, namely, sustainability, population growth, linked earth systems and JEDI. All four class activities require a modest level of research outside of the assigned course readings from the textbook. Requiring students to do data assessment and associated calculations also nudges them to realize the value of simple but effective quantification of data.
ELO 2.1 Identify, describe, and synthesize approaches or experiences.	Earth Sciences 2203 familiarizes students with how to view Earth as a complex set of interconnected systems that while robust on one level can be quite vulnerable on another due to perturbations by humans. Students are exposed to the importance of taking a multidisciplinary approach in understanding earth processes such as earthquakes, volcanoes, drought, floods, and climate change. Through the assigned textbook readings, assignments, and the group research projects, they are challenged outside the classroom to assess how Earth systems can be transformed in both positive and negative ways from the consequences of the intersection of nature and humankind and their activities. The group research project (a "mini-capstone") is of particular importance as it asks the students to identify a key problem relevant to environmental geoscience, describe this topic in terms of the key concepts – sustainability, population growth, linked Earth systems and JEDI, assess the magnitude, frequency and scope of its impact, and provide a synthesis of the future outlook. This activity takes place outside the classroom and directs the students to take a holistic
ELO 2.2 Demonstrate a developing sense of self as a learner through reflection, self-assessment, and creative work, building on prior experiences to respond to new and challenging contexts.	The syllabus outlines assignments that challenge the students to quantitatively evaluate their potential footprint in impacting energy utilization, and in turn, how sustainable they may be. Building on knowledge and methods gained from these two exercises they are then asked to apply them to a larger global scale assessment of how urban water use and climate change are affecting coastal cities. This assignment requires a modest level of critical thinking and straightforward data assessment to quantify the collective impact of water use and rising sea level. The group research project is the culmination of the learning trajectory they are on wherein they can apply the past experiences and skills to explore an environmental problem relevant to today's society. Working in a team they identify the problem of environmental relevance, design a strategy for how and who will describe the various aspects of problem to their peers in the class, and outline what the future holds. Each team member is required to contribute equally to the research effort and is graded on the quality and effectiveness in their role in the project. This requires each participant to reflect on the value of their own effort as the grading is done on the basis on individual performance as well as how their team did overall.

Example responses for proposals within "Citizenship" (from Sociology 3200, Comm 2850, French 2803):

***ELO 1.1** Engage in critical and logical thinking.*	*This course will build skills needed to engage in critical and logical thinking about immigration and immigration related policy through:* *Weekly reading response papers which require the students to synthesize and critically evaluate cutting-edge scholarship on immigration;* *Engagement in class-based discussion and debates on immigration-related topics using evidence-based logical reasoning to evaluate policy positions;* *Completion of an assignment which build skills in analyzing empirical data on immigration (Assignment #1)*

	Completion 3 assignments which build skills in connecting individual experiences with broader population-based patterns (Assignments #1, #2, #3) *Completion of 3 quizzes in which students demonstrate comprehension of the course readings and materials.*
***ELO 2.1** Identify, describe, and synthesize approaches or experiences.*	*Students engage in advanced exploration of each module topic through a combination of lectures, readings, and discussions.* *<u>Lecture</u>* *Course materials come from a variety of sources to help students engage in the relationship between media and citizenship at an advanced level. Each of the 12 modules has 3-4 lectures that contain information from both peer-reviewed and popular sources. Additionally, each module has at least one guest lecture from an expert in that topic to increase students' access to people with expertise in a variety of areas.* *<u>Reading</u>* *The textbook for this course provides background information on each topic and corresponds to the lectures. Students also take some control over their own learning by choosing at least one peer-reviewed article and at least one newspaper article from outside the class materials to read and include in their weekly discussion posts.* *<u>Discussions</u>* *Students do weekly discussions and are given flexibility in their topic choices in order to allow them to take some control over their education. They are also asked to provide* *information from sources they've found outside the lecture materials. In this way, they are able to* *explore areas of particular interest to them and practice the skills they will need to gather information* *about current events, analyze this information, and communicate it with others.* *Activity Example: Civility impacts citizenship behaviors in many ways. Students are asked to choose a TED talk from a provided list (or choose another speech of their interest) and summarize and evaluate what it says about the relationship between civility and citizenship. Examples of Ted Talks on the list include Steven Petrow on the difference between being polite and being civil, Chimamanda Ngozi Adichie's talk on how a single story can perpetuate stereotypes, and Claire Wardle's talk on how diversity can enhance citizenship.*
***ELO 2.2** Demonstrate a developing sense of self as a learner through reflection, self-assessment, and creative work, building on prior experiences to respond to new and challenging contexts.*	*Students will conduct research on a specific event or site in Paris not already discussed in depth in class. Students will submit a 300-word abstract of their topic and a bibliography of at least five reputable academic and mainstream sources. At the end of the semester they will submit a 5-page research paper and present their findings in a 10-minute oral and visual presentation in a small-group setting in Zoom.* *Some examples of events and sites:* *The Paris Commune, an 1871 socialist uprising violently squelched by conservative forces*

	Jazz-Age Montmartre, where a small community of African-Americans–including actress and singer Josephine Baker, who was just inducted into the French Pantheon–settled and worked after World War I. *The Vélodrome d'hiver Roundup, 16-17 July 1942, when 13,000 Jews were rounded up by Paris police before being sent to concentration camps* *The Marais, a vibrant Paris neighborhood inhabited over the centuries by aristocrats, then Jews, then the LGBTQ+ community, among other groups.*

Goals and ELOs unique to Sustainability

Below are the Goals and ELOs specific to this Theme. As above, in the accompanying Table, for each ELO, describe the activities (discussions, readings, lectures, assignments) that provide opportunities for students to achieve those outcomes. The answer should be concise and use language accessible to colleagues outside of the submitting department or discipline. The ELOs are expected to vary in their "coverage" in terms of number of activities or emphasis within the course. Examples from successful courses are shared on the next page.

GOAL 3: Students analyze and explain how social and natural systems function, interact, and evolve over time; how human wellbeing depends on these interactions; how actions have impacts on subsequent generations and societies globally; and how human values, behaviors, and institutions impact multi-faceted, potential solutions across time.

	Course activities and assignments to meet these ELOs
ELO 3.1 Describe elements of the fundamental dependence of humans on Earth and environmental systems and on the resilience of these systems.	Fundamentally, Earth Sciences 2203 explores two overarching domains, how natural Earth processes affect people and, in turn, how people have been impacting Earth. Within these two domains, four key concepts - namely sustainability, population growth (or lack thereof), linked Earth systems, and JEDI - are continually reinforced in various ways via lectures, assigned readings, assignments, and the group research projects. Part 1 of the course presents an overview of these key concepts, general features of Earth and associated natural hazards impacting people. Part 2 provides more details about earth hazards – their frequency, magnitude, and scope, how to monitor them, and how they affect humans, both past and present. The impacts are described in terms of both socio-economic outcomes as well as mechanisms for sustainable recovery. Parts 3 and 4 describe Earth resources such as water, economic minerals, and fossil fuels, how they formed, where are they and how we exploit them. The concept of the "haves and have nots" is discussed in terms of how earth resource wealth is unevenly distributed and how this affects those from underrepresented populations.
ELO 3.2 Describe, analyze and critique the roles and impacts of human activity and technology on both human society and the natural world, in the past, currently, and in the future.	In the syllabus, Parts 3, 4 and 5 explore in some detail how human activities and associated technological advancements have had both a positive and negative impact on earth systems. Lectures, assigned reading, assignments and the group research projects all converge to inform the students that an ever-increasing population places greater demand on earth resources, and in turn, leads to environmental, economic, and health stresses that vary widely from very local to a global scale. Through in-class discussions and assignments, the students are challenged to assess the frequency, magnitude, and scope of varied environmental impacts to the atmosphere, hydrosphere, geosphere, and biosphere from resource exploitation, and how the integrated effects of the impacts translate to diverse attempts to establish sustainable resiliency in various parts of the globe.
ELO 3.3 Devise informed and meaningful responses to problems and arguments in the area of sustainability based on the interpretation of appropriate evidence and an explicit statement of values.	An important thread that connects the various aspects of the course is an ongoing discussion on mitigation and adaptation strategies targeting environmental issues human activities have either caused or exacerbated. With the four key concepts as a framework, where appropriate, the lectures and reading assignments include a discussion of climate change impacts and potential solutions to stabilize and ultimately reduce global warming. The students are exposed to the concept that "good intentions do not always lead to good outcomes" for human activities that on one hand seem beneficial like dam building but can lead to longer term deleterious effects to the environment. The students explore the scale and effectiveness of specific environmental mitigation and adaptation strategies in the group research projects as dictated by the topic selected. They are asked to do this keeping in mind the economic implications but also issues such as environmental, energy, and social justice.