Term Information

Effective Term	Autumn 2024
Previous Value	*Autumn 2013*

Course Change Information

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

New course number

New course description

Course goals and topics

Add to GEN Theme: Sustainability

Retain GEL for Natural Science: Physical

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

The Department of Geography currently offers GEOG 3900 (Global Climate Change: Causes & Consequences), which is in the GEL (Natural Science: Physical Science). The course is one of the two introductory course options required under the newly approved Climate Change Fundamentals Certificate. It is also an elective in several majors in the Geography Department, including Air Transportation and Atmospheric Sciences. We seek to create two versions of this course, which meet GEs and still meet departmental needs. This course change proposal is for one of those versions: a 3-credit GEN Sustainability course, GEOG 3900.01. As a GEL Natural Science course, 3900 already addresses many aspects of sustainability. In this redesign, we have used backward learning design to provide a unique geographic perspective to elaborate on how climate change touches on multiple dimensions of sustainability (human & natural systems earth and environmental systems; economy & governance and engineering/tech).

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)?

We seek to maintain the 3-credit version of the course in order to minimize programmatic implications, as the course is both a GE course and a major requirement (or elective). The Sustainability theme aligns well with the Natural Science focus of the course in the GEL.

Is approval of the requrest contingent upon the approval of other course or curricular program request? Yes

Please identify the pending request and explain its relationship to the proposed changes(s) for this course (e.g. cross listed courses, new or revised program)

We are also proposing a new course, 3900.02. If that is not approved, this course number should not change but should stay 3900, without the decimal point extension, and the course exclusions should stay as they currently are (not open to students with credit for 3901H (410H) OR 420).

Is this a request to withdraw the course? No

General Information

Course Bulletin Listing/Subject Area	Geography
Fiscal Unit/Academic Org	Geography - D0733
College/Academic Group	Arts and Sciences
Level/Career	Undergraduate
Course Number/Catalog	3900.01
Previous Value	*3900*
Course Title	Global Climate Change: Causes and Consequences
Transcript Abbreviation	Global Climate Chg

Course Description	An advanced overview of how Earth's climate changes over time and engage the consequences currently facing our planet. Fundamentals of climate dynamics and broader political, economic, and legal dimensions are explained. Students will explore links between climate and society's energy usage, then critically evaluate scale-specific strategies for mitigation and adaptation.
Previous Value	*Examines the natural and human factors that force changes in our climate and environment and explores strategies for a sustainable environment in the future.*
Semester Credit Hours/Units	Fixed: 3

Offering Information

Length Of Course	14 Week, 12 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, Lima, Mansfield, Marion, Newark, Wooster
Previous Value	*Columbus*

Prerequisites and Exclusions

Prerequisites/Corequisites	
Exclusions	Not open to students with credit for 3900, 3900.02, 3901H
Previous Value	Not open to students with credit for 3901H (410H) or 420.
Electronically Enforced	No

Cross-Listings

Cross-Listings

Subject/CIP Code

Subject/CIP Code	40.0401
Subsidy Level	Baccalaureate Course
Intended Rank	Freshman, Sophomore, Junior, Senior

Requirement/Elective Designation

General Education course:

Physical Science; Sustainability

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

Previous Value

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

- Articulate the scientific basis for, and consequences of, natural and human-produced climate change.
- Describe how Earth's climate has changed over time, and how scientists have developed this knowledge.
- Demonstrate literacy with concepts of energy and carbon cycling, including dimensional analyses, unit conversion, and usage in real-world case studies.
- Propose compelling strategies to mitigate or adapt to climate change that critically acknowledge implications for different stakeholders and integrate quantitative reasoning.

Previous Value

Content Topic List

- Global warming and stainability
- Hydrologic and Carbon Cycles
- Understanding Past Climates
- Orbital Climate Change
- Human History and Climate
- Abrupt Climate Events
- Internal Modes of Climate Variability
- Projected Climate Change

Previous Value

- *Global warming*
- *Hydrologic and Carbon Cycles*
- *Understanding Past Climates*
- *Orbital Climate Change*
- *Human History and Climate*
- *Abrupt Climate Events*
- *Internal Modes of Climate Variability*
- *Projected Climate Change*

Sought Concurrence

No

Attachments

- 3900.01 Sustainability Proposal.pdf: 3900.01 GE Proposal

  (GEC Model Curriculum Compliance Stmt. Owner: Godfrey,Ryan B)
- 3900.01 Syllabus.pdf: 3900.01 Syllabus

  (Syllabus. Owner: Godfrey,Ryan B)
- Cover letter for GEOG 3900 Submission.pdf: Proposal Cover Letter

  (Cover Letter. Owner: Godfrey,Ryan B)
- Draft Course Descriptions.pdf: Course Descriptions

  (Other Supporting Documentation. Owner: Godfrey,Ryan B)
- 3900.01 Syllabus-rev14Nov23.docx: 3900.01 Syllabus Revision

  (Syllabus. Owner: Godfrey,Ryan B)

Comments

- Based on the subcommittee's revision request, the Department of Geography has made revisions to GEOG 3900.01 on all contingencies and recommendations presented from review. See the uploaded revised syllabus which now includes the correct religious accommodation statement to resolve the contingency required by the subcommittee for approval. See the uploaded revised syllabus now reflecting the 2023-24 updated Student Life-Disability Services and Mental Health statements revised for the 2023-24 to incorporate the subcommittee's recommendation. Course Faculty adopted the recommendation to integrate connection to climate change in the first-class session in the revised syllabus. This is now reinforced with introductory readings listed in the first week from the newly released 5th National Climate Assessment Report. *(by Godfrey,Ryan B on 11/15/2023 07:36 PM)*
- Please see Subcommittee feedback email sent 11/03/2023. *(by Hilty,Michael on 11/03/2023 04:32 PM)*

Workflow Information

Status	User(s)	Date/Time	Step
Submitted	Godfrey,Ryan B	09/13/2023 09:27 AM	Submitted for Approval
Approved	Coleman,Mathew Charles	09/13/2023 09:29 AM	Unit Approval
Approved	Vankeerbergen,Bernadette Chantal	10/05/2023 04:09 PM	College Approval
Revision Requested	Hilty,Michael	11/03/2023 04:32 PM	ASCCAO Approval
Submitted	Godfrey,Ryan B	11/15/2023 07:37 PM	Submitted for Approval
Approved	Coleman,Mathew Charles	11/16/2023 09:27 AM	Unit Approval
Approved	Vankeerbergen,Bernadette Chantal	11/16/2023 10:26 AM	College Approval
Pending Approval	Jenkins,Mary Ellen Bigler Hanlin,Deborah Kay Hilty,Michael Neff,Jennifer Vankeerbergen,Bernadette Chantal Steele,Rachel Lea	11/16/2023 10:26 AM	ASCCAO Approval

SYLLABUS
GEOG 3900.01

Global Climate Change: Causes & Consequences
Spring 2024 – Course # XXXXX

COURSE OVERVIEW

Course information

- Class lecture periods: Tuesday, Thursday, 9:35 - 10:55 a.m.
- Credit hours: 3
- Prerequisites: None
- Mode of delivery: In Person

Instructors

Instructor: Dr. Bryan G. Mark (address as Professor Mark)

- Email address: mark.9@osu.edu
- Phone number: 614-247-6180
- Office hours: T/R 11 a.m. -12 p.m. on zoom or by appointment

Graduate Teaching Assistant (GTA): TBD

- Email: TBD.X@buckeyemail.osu.edu
- Office hours: by appointment

Course description

GEOG 3900.01 is a science class open to all majors that will develop an advanced understanding of how Earth's climate functions and changes over different time scales both naturally and as a result of human activity. The climate system is vitally connected to **sustainability**. Students will critically examine the key evidence of how climate is changing,

gain experience with real climate data, and learn directly from climate researchers how they conduct their science. We will explore the diverse consequences and implications of our presently altered climate and how it will likely continue to change into the future. By the end of this class, students will be able to describe the fundamental processes of Earth's climate and the carbon cycle, be familiar with energy units used in everyday life, appreciate broader economic, policy and legal dimensions of climate change, and have experience identifying creative solutions.

There are ***no prerequisites*** for the class. We will use basic arithmetic and some algebra, but no calculus.

Goals and Expected Learning Outcomes (ELOs)

This course is part of the **Sustainability theme** in the University's **General Education (GE)** program because to understand climate change requires analyzing and explaining how the natural climate system is now fundamentally connected to our social and economic systems. ***Ultimately, human caused climate change amplifies the sustainability challenges our society faces.*** Yet because humans have agency in causing changes, we also have power to enact solutions. Therefore, students will link climate change and society's energy demands, sources and usage. They will research and work collaboratively to generate a scale-specific strategy to address climate change with practical actions or policies.

Course-based Goals

1. Students can articulate the scientific basis for, and consequences of, natural and human-produced climate change.
2. Students can describe how Earth's climate has changed over time, and how scientists have developed this knowledge.
3. Students can demonstrate literacy with concepts of energy and carbon cycling, including dimensional analyses, unit conversion, and usage in real-world case studies.
4. Students can propose compelling strategies to mitigate or adapt to climate change that critically acknowledge implications for different stakeholders and integrate quantitative reasoning.

GE Goals & ELOs for all themes:

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: Climate change implicitly engages students in critical and logical thinking about sustainability because of the coupled ways in which society relies on climate, but also impacts climate. Students will critically engage the hypothesis that human activities are altering the balance of radiative energy flows between the sun and Earth by altering the chemistry of the atmosphere, but also reflect on the consequences and implications to future generations (see modules 1, 2).

ELO 1.2 Engage in advanced, in-depth, scholarly exploration of the topic or idea of the theme: The course engages in advanced, in-depth, scholarly study of climate change by challenging students to go beyond mere descriptions of the greenhouse effect to derive a model from fundamental laws of radiation physics, and then critically examine observational data showing evidence of diverse effects to test if hypothesized forcings explain the evidence (see modules 3, 4, 5). Students will also access and cite peer-reviewed science literature about paleoclimatology (proxy short paper assignment) and to substantiate their ideas for a final scale-specific solution to human caused climate change (final research project).

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: Students engage in a combination of informed peer-group discussions and word problems as exercises on a weekly basis (see weekly modules) that provide opportunities to articulate connections to their broader academic knowledge and life experiences.

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: Open to the full diversity of OSU undergraduate students, the class assumes no pre-requisite knowledge, but does encourage self-assessment of developing new understanding by including an entrance and exit survey to assess knowledge and reflect on level of concern for issues, and compute and reflect on a personal “carbon footprint” calculations. Students engage in a number of interactive exercises culminating in a final project that will allow them to draw upon prior experiences to respond to new challenges.

Sustainability Goals & ELOs:

Goal 3: 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: Students will develop an advanced understanding of energy, carbon and water cycles, giving perspective on how they are essential for sustaining life, are impacted by human activity, and contribute to drive climate feedbacks. By connecting the composition of Earth's atmosphere to radiative balance, students will conceptually link fundamental physics to the resilience of the Earth system, as moderated by humans through energy conversion (fossil fuel combustion).

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: Students will learn how human energy conversion technology has changed over time, resulting in an intensification of carbon dioxide emissions that is on the order of 10x more than natural fluxes (e.g. from volcanoes), causing climate alterations, impacting sustainability now and into the future. Students will study in detail how ideas and technology progressed to solve the problem of ice ages (module 9). Yet human activity also holds potential solutions; students critically evaluate alternative energy technologies, and even geoengineering solutions to cool global warming by radiation modification or carbon dioxide sequestration (modules 14, 15).

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: Students will complete a final project involving identifying and formulating a "Scale-specific strategy" to address climate change in a particular context and present a compelling and quantitatively justified case. They will also conduct a formal evaluation of both their own and other group efforts.

Dimensions of Sustainability

Climate change touches on multiple dimensions of sustainability as defined at OSU: human and natural systems; earth and environmental systems; economy and governance; society and culture; engineering, technology and design; and health and well-being. We will focus primarily on the following four in this course:

- ***Human and natural systems*** are central ideas to the entire course, as we the processes and evidence for how human systems are capable of impacting climate change.
- ***Earth and environmental systems*** are given central focus as students learn fundamentals of how the atmosphere of Earth contains carbon and functions to alter flows of radiation that drives all climate. Properly assessing the causes and

consequences of human impacts to climate is premised on understanding how the earth's environmental system works.

- ***Economy and governance*** are addressed with guest faculty experts on the economics of climate change and climate change law. Students appreciate that impacts of climate change are not equal, and how more affluent lifestyles cause more warming, while those who suffer most are often the poorest. They will also critically evaluate the costs and benefits of certain strategies to address climate change.
- ***Engineering, technology, and design*** are central to the ways we convert energy to drive economies, and these concepts are likewise important as students critically evaluate all solutions to climate change.

Legacy GE Goals and ELOs:

This course also meets the **legacy GE (GEL)** requirements in one area - **Natural Science, Physical Science** (i.e. https://asccas.osu.edu/legacy-general-education-gel-goals-and-elos). Specifically, this means we aspire to the following goals: Students understand the principles, theories, and methods of modern science, the relationship between science and technology, the implications of scientific discoveries and the potential of science and technology to address problems of the contemporary world.

We aim to address the **expected learning outcomes** as follows:

1) Students understand the basic facts, principles, theories and methods of modern science.

In this class, a combination of lectures, readings, exercises, and exams will help students comprehend the basic facts of Earth's climate system, including fundamental principles of energy balance, radiative forcing, the greenhouse effect (natural and 'enhanced'), the carbon cycle, feedbacks, natural climate variability, climate extremes and climate modeling. Students will access climate data, practice analyses, and critically evaluate evidence.

2) Students understand key events in the development of science and recognize that science is an evolving body of knowledge.

In this class, students will study the history of climate change science, with a particular focus on how we have understood ice ages, and the way the atmosphere functions.

3) Students describe the inter-dependence of scientific and technological developments.

In this class, students will examine how technology has informed our understanding of climate, what measurements document climate change, and how technology continues to provide critical observations of these changes, from the laboratory to satellites in space. We will visit an actual ice core paleoclimatology lab and see it in action.

4) Students recognize social and philosophical implications of scientific discoveries and understand the potential of science and technology to address problems of the contemporary world.

In this class, students will confront the evidence of climate change impacts to human and natural systems and consider the implications of these for policy makers; climate change is considered one of the leading problems facing the contemporary world. We will provide the basic facts and physical principles involved, and what processes drives climate to change over different time scales. Students will practice with discussion and interact with concepts collectively in online discussions and group exercises, and evaluate dimensions of climate change mitigation, adaptation and geo-engineering during their final project.

HOW THIS COURSE WORKS

Mode of delivery: This course will be delivered in-person. Class periods will feature lectures, in-class exercises, discussions, and on-campus tours. Attendance is expected and will contribute to successful completion of the course. All course materials will be accessible from OSU's **Carmen Canvas** interface.

Weekly activities and materials: This course is divided into weekly ***modules*** that are released on Carmen Canvas by the first scheduled class on Tuesday. These will include variable combinations of discussions, exercises, readings, and quizzes covering content from lecture, recitation and assigned readings. Lecture slides will be posted to Carmen as pdfs after lectures. Many weekly assignments are due the following Monday by 11:59 p.m. Other assignments will have longer due dates, like the proxy description, and final project. Students are expected to keep pace with all deadlines and participate in scheduled class activities, arranging their time to complete exercises and readings, and being prepared for in class quizzes. A weekly ***class schedule*** will be provided outlining content and assignments. The schedule is subject to change so students should be sure to retain most current version. All scheduling changes will be articulated clearly to class via Carmen Announcements.

Credit hours and work expectations: This is a **3-credit-hour course**. According to Ohio State policy, students should expect around 3 hours per week of time spent on direct instruction (instructor content and Carmen activities, for example) in addition to 6 hours of homework (reading, exercises, research and assignment preparation, for example) to receive a passing grade.

Attendance and participation requirements: Student attendance and participation during lectures will be tracked by use of **TopHat**, as well as completion of feedback and entrance/exit surveys. Students are expected therefore to be attentive regularly to the class Carmen page. In addition to regular exercises, quizzes and exams, the following is a summary of expected participation:

- **Lectures: TWICE PER WEEK.** Lectures will be delivered in person by the Professor as well as occasional guest experts and assistants during scheduled class period in the assigned classroom. This is the most regular mode of contacting the Professor and GTA.
- **TopHat: RANDOM DURING LECTURES.** Regular assessment of understanding and participation will be evaluated and recorded via TopHat during lectures. Student participation in these TopHat exercises will be used to assess attendance in class and this, in turn, contributes to the participation category in calculating the final grade. Most value will be participation alone, but a percentage (up to 50%) will be on the correctness.
- **Group activities: PERIODIC.** There will be in-class activities and a final group project that will require active participation and a single group grade. These include an on-campus tour and interactive games. The final project grade will be modified to reflect individual participation effort, but active involvement is expected from all students.

COURSE MATERIALS AND TECHNOLOGIES

Textbooks

We will use sections from **two primary textbooks** for the class. Required weekly readings will help organize our inquiry into global climate change AND provide good reference to basic principles. Because students can access them in different forms, we do not require purchase; the Dessler (2012, 204) it is listed as recommended with OSU Bookstore.

1. **Dessler, A.** ***Introduction to Modern Climate Change.*** Cambridge University Press. A second edition has only recently been published, so the first edition is also still valid for the class.

First edition (2012): ISBN 978-0-521-17315-5. This has been ordered in previous classes and used copies should be available; it is on AMAZON. But it is also available for limited (2 users at a time) electronic resource through the OSU LIBRARY (accessible when on OSU computers):

https://library.ohio-state.edu/record=b7011024~S7

Second edition (2014): ISBN 978-1-107-48067-4. This newer version has been ordered and should be available at OSU Bookstore. It is also on online sites (e.g. Amazon or B&N for ~$40, or as an eBook on Amazon or Google ~$30).

A second available text is Mathez and Smerdon (2018).

2. **Mathez, E. and J. Smerdon.** ***Climate Change: The Science of Global Warming and our Energy Future.*** Columbia University Press. Full open access version online (pdf chapter downloads): https://doi.org/10.7312/math17282. ISBN 9780231547871 (e-book).

Other readings, media:

Occasionally we will also assign readings from additional sources (scientific articles, news, web pages, book sections). When appropriate, we will direct students to important publicly available climate change information like the 5th National Climate Assessment Report (https://nca2023.globalchange.gov/) and materials from the Intergovernmental Panel on Climate Change (https://www.ipcc.ch/). These will be announced in lecture and posted as assignments the modules where we will provide relevant web links or pdfs on Carmen. We will indicate the relevant weekly readings by date.

Other information complementary to the class can be found in mixed media (e.g. videos, podcasts). These will all be provided as pdfs or URL links via Carmen and linked to the weekly modules. One of the valuable resources students will obtain in the class will be a repository of articles, web media, and more that will be archived in Carmen.

Because our class learning goals include becoming familiar with peer-reviewed scientific literature, and critically evaluating material from the internet, we will introduce students to many sources of information as well as tools to organize, cite and reference them. We will enlist the assistance of a course librarian from the OSU Libraries, Professor Danny Dotson.

Course technology

For help with your password, university email, Carmen, or any other technology issues, questions, or requests, contact the Ohio State IT Service Desk. Standard support hours are available at ocio.osu.edu/help/hours, and support for urgent issues is available 24/7.

- **Self-Service and Chat support:** ocio.osu.edu/help
- **Phone:** 614-688-4357(HELP)
- **Email:** servicedesk@osu.edu
- **TDD:** 614-688-8743

Basic computer and web-browsing skills are expected, and navigating Carmen is an essential skill for this course. For questions about specific functionality, see the Canvas Student Guide.

REQUIRED TECHNOLOGY SKILLS SPECIFIC TO THIS COURSE

- CarmenZoom virtrual meetings
- Recording a slide presentation with audio narration
- Recording, editing, and uploading video

REQUIRED EQUIPMENT

- Computer: current Mac (OS) or PC (Windows) with high-speed internet connection
- Webcam: built-in or external webcam, fully installed and tested
- Microphone: built-in laptop or tablet mic or external microphone
- Other: a mobile device (smartphone or tablet) or landline to use for BuckeyePass authentication

REQUIRED SOFTWARE

- Microsoft Office 365: All Ohio State students are now eligible for free Microsoft Office 365 ProPlus through Microsoft's Student Advantage program. Full instructions for downloading and installation can be found at go.osu.edu/office365help.
- Zoom (https://osu.zoom.us/) is the academic audio web conferencing solution for Ohio State, and we will be using it for some guest lectures, possible office hour options, and interactive course elements.
    - Getting started with CarmenZoom
- TopHat: We will use TopHat to deliver quizzes during lecture for synchronous student response.

CARMEN ACCESS

You will need to use BuckeyePass multi-factor authentication to access your courses in Carmen. To ensure that you are able to connect to Carmen at all times, it is recommended that you take the following steps:

- Register multiple devices in case something happens to your primary device. Visit the BuckeyePass - Adding a Device help article for step-by-step instructions.
- Request passcodes to keep as a backup authentication option. When you see the Duo login screen on your computer, click **Enter a Passcode** and then click the **Text me new codes** button that appears. This will text you ten passcodes good for 365 days that can each be used once.

- Download the Duo Mobile application to all of your registered devices for the ability to generate one-time codes in the event that you lose cell, data, or Wi-Fi service.

If none of these options will meet the needs of your situation, you can contact the IT Service Desk at 614-688-4357 (HELP) and IT support staff will work out a solution with you.

GRADING AND FACULTY RESPONSE

How your grade is calculated (% breakdown)

ASSIGNMENT CATEGORY	% POINTS
Participation	5
Exercises & Discussions	20
Paleoclimate proxy short paper	10
Quizzes	15
Exams (2)	30
Group video presentation	20
Total	**100**

Assignment descriptions:

Participation: This will be assessed based on student TopHat participation, completion of entrance/exit questionnaires, and attendance taken selectively for in-class activities).

Exercises & Discussions: Students will conduct weekly exercises or discussions. Exercises will comprise homework problems or other activities related to material presented in class. Discussions will comprise short answer responses to prompts using Carmen Discussions. Expectations for what comprises full credit will be further articulated for each module. Due dates may extend beyond the end of weekly modules but will be specified in the assignment.

Paleoclimate proxy short paper: Students will research and complete a short critical description about a paleoclimate proxy of their choice, demonstrating proper citation of information, including at least two peer-reviewed sources. 3 pages.

Quizzes: Quizzes will be given using Carmen quizzes, and will be based on material presented in lectures, readings, videos and other online material from the respective module. Note that some material from previous modules may also be on quizzes. They are generally released after the Thursday lecture and due the following Monday.

Exams: Two exams will be given during the semester based on class content. Guidance will be given beforehand about the format and scope of each exam given.

Group video presentation: Groups will be assigned early in the class, and students will be interacting throughout the semester to select a topic and complete a video presentation. Students will also conduct reviews of other group presentations and engage in Q&A with students from other groups.

Late assignments

Please refer to Carmen for due dates. Generally, modules will be completed by midnight on Monday night before new modules begin on Tuesdays (first class session of each week). Late assignments will be penalized by 10% per day late, and only accepted up to a maximum of 4 days late. If students anticipate having conflicts they are expected to discuss with instructors ahead of time.

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

Instructor feedback and response time

We provide the following list to give you an idea of our intended availability throughout the course. (Remember that you can call **614-688-HELP** at any time if you have a technical problem.)

- **Grading and feedback:** For regular assignments, you can generally expect feedback within 10 days. Some exercises and papers will take longer to grade.
- **Email:** We will generally reply to emails and Carmen messages within **24 hours on days when class is in session at the university**. Please add "G3900" to the subject in your email to identify yourself; we teach multiple classes.

- **Discussion board:** We will check and reply to messages in the Carmen discussion boards regularly.

COURSE SCHEDULE

G3900 Sustainability Theme GE WEEKLY SCHEDULE*

Class Topics, Required Readings, and Exercises

*Note: These topics and readings are *subject to change*! Students will be advised of updates to the schedule on Carmen and should follow the version with most current date.

Lectures 2x/week (160 mins).

Wk	Module	Lecture	Date	Recitation Discussion/Exercise	Reading
1	Welcome & "Global Warming 101"	1. Introduction, syllabus, connections to climate change	T 1/09	***Discussion 1* – intro self (due 1/15)** ***Climate Questionnaire (due 1/18)***	5th NCA (https://nca2023.globalchange.gov/) skim overview; Chp 2
		2. What is climate and weather variability?	R 1/11		Dessler 1
2	Is the climate changing? Critically assessing evidence	3. Considering the data: is climate changing?	T 1/16	***Exercise 1:* geography of climate – data & global patterns (due 1/22)**	Dessler 2, 3 5th NCA (https://nca2023.globalchange.gov/): Chp 3
		4. More evidence of current climate change; intro to radiation	R 1/18		
3	Peer-review & Library Resources;	***Library resources, identifying peer review –***	T 1/23	***Discuss 2:* weather disasters & climate change (due 1/29)**	Dessler 3, 4 Mathez & Smerdon, 2018

	Climate system dynamics	***librarian Danny Dotson***			(M&S) Chp 1 (Chp 2 in 2009 edition)
		5. Sun & Atmosphere Energy Balance	R 1/25		
4	Earth's planetary energy balance; the greenhouse effect (GHE)	6. Simple model of GHE from basic radiation laws	T 1/30	***Exercise 2: proxy topic/peer review (due 2/05)***	Dessler 4 Mathez 5 M&S 1-3
		Q&A with GTA	R 2/01		
5	Flows of Energy: models and reality	7. Simple model of Greenhouse; Real Atmosphere	T 2/06	***Exercise 3: climate data 2 (due 2/12)***	Dessler 3, 4 M&S 1, 2, 3, 5 Weart: https://history.aip.org/climate/co2.htm
		8. Earth's actual climate system; global circulation of atmosphere & oceans; ENSO	R 2/08		
6	Humans and the carbon cycle; predicting future changes	9. The carbon cycle(s) – slow and rapid; reservoirs and flows.	T 2/13	***Midterm study guide (optional, indep)***	Dessler 5 M&S 4
		10. Feedbacks, residence time; how carbon influences climate & humans alter the C-cycle	R 2/15	***Discuss 3: popular media (due 2/19)***	

7	Scenarios of future & Midterm Exam	11. Emission scenarios of future climate changes; Impacts of climate change	T 2/20	***Final project scaffold (FPS): Pick group by 2/27 (else assigned)***	Dessler 6-8 Climate Science Special Report (see Chp 4 on modeling) https://science2017.globalchange.gov/
		MIDTERM EXAM	R 2/22		
8	Paleoclimatology: Understanding past climates	12. Paleoclimatology	T 2/27	***Class time for FP groups to meet, share contact info*** ***Proxy description (due 3/04)***	M&S 7 Dessler 2.2; 7.3 Bradley, Paleoclimatology, Chp 1; Cronin 2, Methods
		13. Natural climate variability and how we've come to understand it	R 2/29		
9	Ice Ages: An historic science discovery of Ice Ages, and modern glaciologist story	14. Discovery of the pace of ice ages – historical case study of science & worldviews	T 3/05	***Discuss:*** ***Reflections on historical development of science: Ice Ages*** ***Exercise 4:*** ***Carbon footprint (due 3/18)***	Imbrie & Imbrie, Chp 1-3: *Ice Ages: Solving the Mystery* Supplemental: Hodell (2016), "The smoking gun of the ice ages" Shakun, 2015
		GUEST: Dr. Michalea King: Big Ice Changes – Ice sheets & sea level	R 3/07		
10	**Spring Break**	***No class***	T 3/12	Be safe -- get some rest!	
		No class	R 3/14		

11	OSU ice core research & practicing modeling scenario choices	***Class divided to groups; report to respective location***	T 3/19	***SYNCHRONOUS activities:*** ***Tour of BPCRC and EnROADS climate simulation*** ***FPS: Final project group intro video (due 3/25)***	
		Class divided to groups; report to respective location	R 3/21		
12	Psychology, Politics and legal dimensions of climate change	***GUEST: Prof Matthew Hamilton, SENR:*** From cognition to collective action	T 3/26	***FPS: show quantitative reasoning for group strategy (due 4/01)***	Dessler 13-14
		GUEST: Prof Carlarne, Law School: Legal considerations of climate change	R 3/28		
13	A focus on Ohio	***Dr. Mark Shanahan:*** Considering Ohio's energy geography	T 4/02	***FPS: Final paper précis and biblio DUE (Mon, 4/08, 11:59 pm)***	Dessler Chp 8,9 Ohio's energy portfolio: https://www.eia.gov/state/?sid=OH ***S^3 project: Final video presentations uploaded to discussion forum by 4/16***
		20. A view of Ohio's present & future climate from your State Climate Office ***(with Dr. Aaron Wilson, State Climatologist)***	R 4/04		

14	How do we deal with (and pay for) the problem?	Wedges Game	T 4/09	***In-class exercise***	
		GUEST: Prof. Brent Sohngen: Economics of climate change	R 4/11	***Exercise 5: scaling up personal choices (due 4/15)***	Dessler 11, 12 Nordhaus, 2017
15	Adaptation, mitigation & geoengineering	***Group presentations: project pitches***	4/16	***Discussion: Final project peer-reviews and responses to questions from peers***	***S^3 project: Final video presentations & peer-review***
			4/18	***Exercise: group project assessment of effort; exit survey***	Take exit survey (Google) All material due Mon, 29 April

Final papers due: Monday, April 29, 11:59 pm.

OTHER COURSE POLICIES

Discussion and communication guidelines

The following are my expectations for how we should communicate as a class. Above all, please remember to be respectful and thoughtful.

- **Writing style**: Students should use proper grammar, spelling, and punctuation. A more conversational tone is fine for non-academic topics in class discussion forums.
- **Tone and civility**: Let's maintain a supportive learning community where everyone feels safe and where people can disagree amicably. Remember that sarcasm doesn't always come across online.
- **Citing your sources**: Proper citations of your sources will be emphasized in this class. For the textbook or other course materials, list at least the title and page numbers. For online sources, include a link. See academic integrity policy below.
- **Backing up your work**: Consider composing your academic posts in a word processor, where you can save your work, and then copying into the Carmen discussion

Academic integrity policy

- **Quizzes and exams**: Students must complete the weekly quizzes and exams by themselves, without external help or communication from the internet or other people. Accessing personal notes from class material is permitted unless indicated otherwise.
- **Written assignments**: Students' written assignments, including discussion posts, should be their own original work. In formal assignments, students should follow a consistent citation style (e.g. MLA, APA, or AGU) to cite the ideas, conclusions and words of their research sources. ***It is essential that students use a proper citation style consistently (further explanation will be provided on writing assignments).*** Students are encouraged to have material proofread before submitting them — but no one else should revise or rewrite student work.
- **Reusing past work**: In general, students are prohibited in university courses from turning in work from a past class, even if modified. Students should discuss the situation with instructors in advance if there is any doubt.
- **Collaboration and informal peer-review**: The course includes opportunities for formal collaboration with your classmates. While study groups and peer-review of major written projects is encouraged, remember that comparing answers on a quiz or assignment is not permitted. If a student is unsure about a particular situation, ask ahead of time.
- **Group projects**: This course includes a group project and group activities. It can be stressful for students when it comes to dividing work, taking credit, and receiving grades and feedback. Instructors have attempted to make the guidelines for group work as clear as possible for each activity and assignment, but students should ask about any uncertainties or issues.

Ohio State's academic integrity policy

It is the responsibility of the Committee on Academic Misconduct (COAM) to investigate or establish procedures for the investigation of all reported cases of student academic misconduct. The term "academic misconduct" includes all forms of student academic misconduct wherever committed; illustrated by, but not limited to, cases of plagiarism and dishonest practices in connection with examinations. Instructors shall report all instances of alleged academic misconduct to the committee (Faculty Rule 3335-5-487). For additional information, see the Code of Student Conduct http://studentlife.osu.edu/csc/.

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 we suspect that a student has committed academic misconduct in this course, we are obligated by university rules to report my suspicions to the COAM. 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 us. 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)*

Copyright disclaimer

The materials used in connection with this course may be subject to copyright protection and are only for the use of students officially enrolled in the course for the educational purposes associated with the course. Copyright law must be considered before copying, retaining, or disseminating materials outside of the course.

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 at titleix@osu.edu.

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's Counseling and Consultation Service (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 also available 24/7 by dialing 988 to reach the Suicide and Crisis Lifeline.

ACCESSIBILITY ACCOMMODATIONS FOR STUDENTS WITH DISABILITIES

Requesting accommodations

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 us know immediately so that we can privately discuss options. To establish reasonable accommodations, we 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.

If you are isolating while waiting for a COVID-19 test result, please let me know immediately. Those testing positive for COVID-19 should refer to the Safe and Healthy Buckeyes site for resources. Beyond five days of the required COVID-19 isolation period, I may rely on Student Life Disability Services to establish further reasonable accommodations. You can connect with them at slds@osu.edu; 614-292-3307; or slds.osu.edu.

Religious Accommodations

It is Ohio State's policy to reasonably accommodate the sincerely held religious beliefs and practices of all students. The policy permits a student to be absent for up to three days each academic semester for reasons of faith or religious or spiritual belief.

Students planning to use religious beliefs or practices accommodations for course requirements must inform the instructor ***in writing no later than 14 days*** after the course begins. The instructor is then responsible for scheduling an alternative time and date for the course requirement, which may be before or after the original time and date of the course requirement. These alternative accommodations will remain confidential. It is the student's responsibility to ensure that all course assignments are completed.

Accessibility of course technology

This course requires use of Carmen (Ohio State's learning management system) and other online communication and multimedia tools. If you need additional services to use these technologies, please request accommodations with your instructor.

- CarmenCanvas accessibility

- Streaming audio and video
- CarmenZoom accessibility
- Collaborative course tools

GE Theme Course Submission Worksheet

GEOG 3900.01, 3 credits

"Global Climate Change: Causes & Consequences"

Sustainability Theme

General Expectations of All Themes

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

Please briefly identify the ways in which this course represents an advanced study of the focal theme. *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. (50-500 words)*

G3900.01 presents an advanced study of climate change which is thematically tied to sustainability by introducing human induced global warming as a problem emerging from coupled natural and social systems where humans have agency and responsibility. Moreover, climate change is broadly impactful and solutions are not simple; it is a 'wicked problem' that challenges students to critically engage with multiple disciplines to understand. While open to students of all majors, this course challenges students to link and synthesize diverse concepts at an advanced level. Understanding the causes of global climate change requires knowledge of the biophysical processes within the Earth system – its climate, energy balance, and biogeochemical cycles – and both the natural and human-caused factors that drive climate change. In the process, they learn about various forms of energy – from the planetary radiation balance to forms and sources of power to drive modern society, including alternatives to fossil fuels. Moreover, students are exposed to concepts of economics, psychology, political science and law as they learn how widespread and complex consequences of climate change challenge society to rethink sustainable development and net-zero energy conversion technology. The course relies on cutting-edge research since climate changes and their implications are unfolding in real time. Students are required to access and cite the scientific peer-reviewed literature, as guided by our class librarian who lectures and provides resources to assist the writing of the paleoclimate proxy paper and final project. Finally, students draw on basic algebraic skills to undertake more advanced dimensional analyses to quantify energy consumption and carbon emissions.

ELO 1.1 Engage in critical and logical thinking about the topic or idea of the theme. *Please link this ELO to the course goals and topics and indicate specific activities/assignments through which it will be met. (50-700 words)*

To meet the course goal of understanding the fundamentals of Earth's climate and how it changes, students build conceptual understanding starting from fundamental physical principles and then apply logic and scientific reasoning to model the system and test hypotheses. For example, in modules 1 and 2, students gain advanced appreciation of Earth's greenhouse effect by learning the fundamental radiation laws after reviewing wavelengths and conservation of energy. Through lectures and readings, they derive a simple layered model of the Earth's atmosphere. Students then use it to compute surface temperature knowing incoming radiation and relative abundance of greenhouse gases, as expressed in the numbers of atmospheric layers of the model. They test scenarios of more greenhouse gases by

adding additional layers to the atmosphere and computing resulting increases in temperature without additional incoming solar radiation. They also see how a generalized form of the model can be tested against neighboring planets to see if it can explain the relative power of greenhouse effects on other planets – and it does. They also synthesize the basic chemistry of photosynthesis and respiration into box models of carbon fluxes between terrestrial, oceanic and atmospheric reservoirs to quantify the nature of human-induced alterations leading to global warming.

To meet the goal of acquiring and intercomparing actual climate data, students have take-home exercises directing them to acquire publicly accessible climate data in various forms. They use online tools to compute and compare trends over time. They also evaluate and intercompare time series of paleoclimate proxy data with measurements to provide quantitative evidence distinguishing human altered climate change from natural. To meet the goal of thoughtfully engaging with current events, students take what they're learning about human impact on climate and reflect critically upon the accuracy of media portrayals of climate change related topics. They come to their own conclusions and express them in succinct passages that they will post to a small group of classmates. They also respond constructively to other commentaries made by their fellow students. This process helps them develop their own conclusions about how climate change is impacting our world and how people are responding.

To meet the goal of appreciating the history of climate change science, students read a section of a popular audience history of how scientists came to understand and solve the problem of what paced the cyclic alterations between glacials and interglacial periods we know as “Ice Ages.” They reflect on the historical context and roles of world view in influencing development of ideas. They then reconcile how, despite having a short observational record of temperature changes, there is very strong logical basis for the reality of humans causing recent climate change based on a long history of experimentation, and that science progresses by testing and falsifying with evidence.

Students examine human-based approaches to address climate change through energy unit conversions and basic carbon balance calculations. This practice meets the goal of building practical energy literacy and allows students to exercise quantitative tools of logic to critically compare implications of varying strategies to address climate change.

ELO 1.2 Engage in an advanced, in-depth, scholarly exploration of the topic or idea of the theme.
Please link this ELO to the course goals and topics and indicate specific activities/assignments through which it will be met. (50-700 words)

Students have multiple opportunities to engage in in-depth scholarly exploration, and two written papers requiring proper citation of scientific literature. To delve deeper into the learning goal of understanding natural climate variability and how science is able to gain insights into past climate, students undertake a guided independent inquiry into paleoclimate proxies. They select a proxy that interests them, then research how it works, and critically describe how it can be used to inform us about past climate and environmental changes. They must explicitly account for the assumptions, strengths, weaknesses and sources of uncertainty in the methodology, and then use library databases to search for case study examples of the proxy being used in research from the scientific peer-reviewed literature, and summarize in writing, properly citing sources. In the group research and video presentation project, students address the goal of critically examining solutions by proposing scale-specific strategies. They must conduct in-depth research on the technology or methods they propose, accounting quantitatively

for the impact on carbon emissions. They must substantiate their findings with evidence from published research, and properly cite findings from at least three peer-reviewed research studies.

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. *Please link this ELO to the course goals and topics and indicate specific activities/assignments through which it will be met. (50-700 words)*

Students engage in a combination of informed peer-group discussions and word problems as exercises on a weekly basis that provide opportunities to articulate connections to their broader academic knowledge and life experiences. They are assigned randomly to groups of fellow classmates and are then required to compose thoughtful responses to prompts that ask them to reflect upon either current weather and climate events, or media portrayals of climate change. Once these are submitted, they are allowed to view their peer-responses, and are required to respectfully respond to at least two. This meets the class goal to thoughtfully engage with current events and media presentations related to climate change by connecting to relevant scientific understanding and uncertainty. Also, word problems requiring dimensional analysis of energy and carbon and unit conversion provide students a way to relate their lives beyond class directly to the topic. This meets the ELO's of demonstrating practical energy literacy and critically examining options for solutions. This allows students to apply mathematical reasoning skills (gained outside class, but no calculus required) to the theme of climate change, gaining quantitative connection and critical insight into key aspects of climate change (energy and carbon). Moreover, the examples relate directly to student livelihoods by considering examples relating to how they live and the implications for equivalent carbon emissions resulting from their daily activities. The final project also addresses the learning goal of using fact-based knowledge to assess a scale-specific problem and solution, and the students work as teams, drawing upon their diverse backgrounds and experiences to creatively identify the problem and solution. Students are also able to write their final individual research paper on any theme relating to climate change; many may opt to use this to connect more substantively to their growing expertise or passion based in their major or other academic field of knowledge.

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. Please link this ELO to the course goals and topics and indicate specific activities/assignments through which it will be met. (50-700 words)

Open to the full diversity of OSU undergraduate students, the class assumes no pre-requisite knowledge, but does encourage self-assessment of developing new understanding by including an entrance and exit survey to assess knowledge. This is based on standards of climate change literacy as developed by the American Association for the Advancement of Science. To meet the twinned goals of critically examining options for human society for mitigating, adapting, and otherwise geoengineering responses to an altered climate, and working with others to use fact-based knowledge to design solutions, students will engage in a number of creative works that will feature opportunities to develop a sense of their own learning and build on prior experiences. The class is structured to include three inter-active classroom exercises: in-person experience of climate science in action (research tour of Byrd

Polar and Climate Research Center); creative role-playing where students work in teams to simulate impacts of policy decisions from different economic sectors, checking results with real-time models of future warming based on national determined commitments (Climate Interactive); and team based portfolio construction of "wedges" to reduce emissions across diverse economic sectors, accounting for self-critically scored impressions by different stakeholders (Carbon Wedges). The final project features composing a video presentation, and opportunities to review and evaluate their own and their teammates' participation, as well as conduct peer-review of fellow classmates' projects.

Specific Expectations of Courses in Sustainability

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. Please link this ELO to the course goals and topics and indicate specific activities/assignments through which it will be met. (50-700 words)

Earth's climate is fundamentally linked to environmental systems involving the recycling of chemical elements (e.g. carbon) throughout the spheres of the Earth System that ultimately have bearing on the levels of greenhouse gases in the atmosphere. Human energy conversion by fossil fuel combustion has facilitated improved well-being and development. But this strongly moderates these biogeochemical processes and thus impacts the climate by altering the radiative properties of the atmosphere. In addressing the learning goal of how the climate system works and how human activity moderates it, students will demonstrate understanding of how the natural climate system operates, including fundamental drivers and feedbacks. This will involve coming to grips with thresholds within these biogeochemical and socio-ecological systems. They will deepen a critical appreciation by examining paleoclimate data documenting these processes throughout Earth's planetary history. They will derive and apply a 1-dimensional model of the natural greenhouse effect, and then alter it by demonstrating the effect of human-induced enhancement. Then, they will be challenged with understanding the myriad ways humans alter these processes, and benefit from them. This requires appreciating how social systems are integrated, and this is accomplished by integrating lectures by guest experts sharing perspective and methods of economics and energy policy. Dr. Shanahan reviews the development of energy in Ohio, revealing many important benefits and ecological impacts of coal, oil and natural gas development, as well as political realities that challenge development of alternative energy. Learning goals reinforce that many options need to be decided through a political system with divergent interests, and students are given opportunities to assess critically both costs and benefit involved in any solution, while being explicit about the political realities of implementation.

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. *Please link this ELO to the course goals and topics and indicate specific activities/assignments through which it will be met. (50-700 words)*

In distinguishing human-induced climate change from natural climate change, students will access actual observations of temperature and carbon dioxide levels over time, and critically analyze relative rates of

change over time. In meeting course goals, students will practice a critical reading of time series graphs and be familiar with intercomparing rates of change. Activities will enable students to examine the range of time scales over which natural variations in climate occur in order to understand the role of human activity in the context of past changes in climate. For example, students will plot historical temperature time series data for the month they were born and assess the trend over time. This encourages students to consider the reasoning behind annual variations in temperature and why the historical trend appears as it does. In comparing these trends to trends in fossil fuel emissions, students can draw connections in the relationship between human emissions and temperature trends.

This is further emphasized through discussion of the ice ages. The ice ages occur naturally with a rhythm that is driven ultimately by solar radiation changes but also involves feedbacks with carbon dioxide levels in the ocean-atmosphere system which also occur naturally as a function of changing temperature. Human emissions of carbon dioxide have altered the rhythms of the ice ages, and this has implications for how the impacts of climate change will be felt by different communities including those here in Ohio and the Midwest. Projections of future climate will be critically examined, and students will learn how largest sources of uncertainty relate to human decisions, that are not rational but highly political. A particular emphasis will be placed on the role of world views in influencing scientific theory by using a popular audience text about the discovery of the Ice Ages. Students will critique how human activity and technology are interwoven to allow for discovery and advancement of knowledge.

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. Please link this ELO to the course goals and topics and indicate specific activities/assignments through which it will be met. (50-700 words)

Students will apply the knowledge gained in exercises, discussions, midterm exam, and readings to both assess a specific problem related to the production of greenhouse gases by human activities and devise an informed and meaningful response. This is the essence of the final group project and video presentation, where students work with others on a team, and not only demonstrate critical thinking but practice compelling communication. This meets multiple learning goals of critical and quantitative thinking around energy and carbon and is tied fundamentally to sustainability. Successful demonstration will require accessing appropriate evidence from the scientific peer-reviewed literature. It will also require students to acknowledge and express values by making their case for action as a “pitch” to a legislative or policy body of their choice. For example, students can frame their problem/solution to be one applying globally, with the policy body as the United Nations, or very local, with the policy body being the Ohio State University Board of Trustees. Fellow students will evaluate their presentation based on how compelling they were with presenting evidence and express their relative preference by allocating imaginary funding amounts. This integration of science and values within a decision-making framework implicitly engages students in a process of informing meaningful responses to problems holistically.