Term Information

Effective Term	Autumn 2023
Previous Value	*Autumn 2021*

Course Change Information

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

(1) by changing the course number to 2911, because, as it evolved, this course has become more challenging for most of its students, and (2) changing the short name from 'Climate Change 'to 'The Climate Crisis'

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

Now that the entire GE system is being re-organized at OSU, we propose to continue the course, with no abrupt change in scope or content, but modifying its status and description in two minor ways: (1) by changing its course number to 2911, because, as it evolved, this course has become more challenging for most of its students, and (2) by changing its short name from 'Climate Change' to 'The Climate Crisis', because the present-day climate crisis is the major focus of the course, not just the general phenomenon of climate change, a theme that runs throughout geological history (though that history does provide an important backdrop to the study of anthropogenic climate change).

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? 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)

This course is cross-listed in History and EarthSC

Is this a request to withdraw the course? No

General Information

Course Bulletin Listing/Subject Area	Evol, Ecology & Organismal Bio
Fiscal Unit/Academic Org	Evolution, Ecology & Org Bio - D0390
College/Academic Group	Arts and Sciences
Level/Career	Undergraduate
Course Number/Catalog	2911
Previous Value	*1911*
Course Title	The Climate Crisis: Mechanisms, Impacts, and Mitigation
Previous Value	*Climate Change: Mechanisms, Impacts, and Mitigation*
Transcript Abbreviation	IntrdiscpClimtChng
Course Description	Examination of the basic science of climate change, of the ability to make accurate predictions of future climate, and of the implications for global sustainability by combining perspectives from the physical sciences, the biological sciences, and historical study. Team-taught with faculty members in EarthSc and History.
Semester Credit Hours/Units	Fixed: 4

Offering Information

Length Of Course	14 Week, 12 Week, 8 Week, 7 Week, 6 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, Recitation
Grade Roster Component	Recitation
Credit Available by Exam	No
Admission Condition Course	No
Off Campus	Never
Campus of Offering	Columbus, Lima, Mansfield, Marion, Newark, Wooster
Previous Value	*Columbus, Marion*

Prerequisites and Exclusions

Prerequisites/Corequisites	
Exclusions	Not open to students with credit for History 1911, History 2911, EEOB 1911, EarthSc 1911 or EarthSc 2911.
Previous Value	Not open to students with credit for History 1911 or EarthSc 1911.
Electronically Enforced	Yes

Cross-Listings

Cross-Listings	Cross-listed in EarthSc and History.

Subject/CIP Code

Subject/CIP Code	40.0601
Subsidy Level	Baccalaureate Course
Previous Value	*General Studies Course*
Intended Rank	Freshman, Sophomore, Junior, Senior
Previous Value	*Freshman, Sophomore*

Requirement/Elective Designation

General Education course:

Historical Study; Biological Science; Physical Science; Lived Environments; Sustainability

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

Previous Value

General Education course:

Historical Study; Biological Science; Physical Science

Course Details

Course goals or learning objectives/outcomes

- Students understand the modern scientific consensus on the causes and mechanisms of climate change
- Students appreciate the complex nature of the climate system, including the vital role of the oceans
- Students recognize the spatial heterogeneity of the effects of climate change
- Students recognize the impact of past climate change on humans, including droughts, agricultural collapse, and resulting wars over limited resources
- Students understand the basic choices available to societies to slow down, mitigate, or adapt to climate change

Content Topic List

- The Climate System
- CO2 and Climate Change
- Biological Responses to Climate Change
- Historical Experiences of Major Climate Change
- Effects of Climate Change on Modern Human Infrastructure
- Human Response to Climate Change: Mitigation and Adaptation

Sought Concurrence

No

Attachments

- EEH1911 SYLLABUS Autumn 2021.docx: Old Syllabus

  (Syllabus. Owner: Hamilton,Ian M)
- EEOB Curriculum Maps November 2021.xlsx: EEOB Curriculum Maps

  (Other Supporting Documentation. Owner: Hamilton,Ian M)
- EEH2911 SYLLABUS Autumn 2022 Dec 13 2021.docx: Syllabus - Initial Submission

  (Syllabus. Owner: Hamilton,Ian M)
- submission-lived-environments Dec 13 2021.pdf

  (Other Supporting Documentation. Owner: Hamilton,Ian M)
- submission-sustainability Dec 13 2021.pdf

  (Other Supporting Documentation. Owner: Hamilton,Ian M)
- EEH2911 SYLLABUS Autumn 2022 revised March 3 2022.docx: Revised Syllabus March 3

  (Syllabus. Owner: Hamilton,Ian M)
- Response to Natural and Mathematical Sciences Panel of the ASC Curriculum Committee.pdf: Response to Panel

  (Other Supporting Documentation. Owner: Hamilton,Ian M)
- GE Revisions Cover Letter - Nov 10 - emg.docx: Revised Cover Letter

  (Cover Letter. Owner: Hamilton,Ian M)
- interdisciplinary-team-taught-inventory - ES2911 - Revised Nov 9 2022.pdf: Interdisciplinary Team Taught Inventory

  (Other Supporting Documentation. Owner: Hamilton,Ian M)
- EEH2911 SYLLABUS Revision - 12.14.2022 jlg.docx: Revised Syllabus December 2022

  (Syllabus. Owner: Hamilton,Ian M)

Comments

- Earth Science and History will also submit this request

  History and Earth Science 2911 and EEOB 1911 have been added to the exclusions

  The Interdisciplinary Team-Taught Course Inventory is attached

  Please see the response to panel for responses to the feedback email sent 2-7-22 *(by Hamilton,Ian M on 12/15/2022 10:18 AM)*
- Please see Panel feedback email sent 08/02/2022. *(by Hilty,Michael on 08/02/2022 08:03 AM)*
- Please see feedback email sent to the departments/unit 2-7-22 RLS *(by Steele,Rachel Lea on 02/07/2022 03:35 PM)*
- -On the form in curriculum.osu.edu, History and Earth Science 2911 now need to be exclusions as well.
  -Please fill out and upload the Interdisciplinary Team-Taught Course Inventory https://oaa.osu.edu/sites/default/files/uploads/general-education-review/new-ge/interdisciplinary-team-taught-inventory.pdf (might be helpful to read OAA instructions https://oaa.osu.edu/sites/default/files/uploads/general-education-review/new-ge/interdisciplinary-team-courses-description-expectations.pdf) *(by Vankeerbergen,Bernadette Chantal on 01/04/2022 03:49 PM)*

Workflow Information

Status	User(s)	Date/Time	Step
Submitted	Hamilton,Ian M	12/14/2021 02:08 PM	Submitted for Approval
Approved	Hamilton,Ian M	12/14/2021 02:10 PM	Unit Approval
Revision Requested	Vankeerbergen,Bernadette Chantal	01/04/2022 03:55 PM	College Approval
Submitted	Hamilton,Ian M	01/12/2022 12:38 PM	Submitted for Approval
Approved	Hamilton,Ian M	01/12/2022 12:39 PM	Unit Approval
Approved	Vankeerbergen,Bernadette Chantal	01/18/2022 11:51 AM	College Approval
Revision Requested	Steele,Rachel Lea	02/07/2022 03:35 PM	ASCCAO Approval
Submitted	Hamilton,Ian M	03/03/2022 01:09 PM	Submitted for Approval
Approved	Hamilton,Ian M	03/03/2022 01:14 PM	Unit Approval
Approved	Vankeerbergen,Bernadette Chantal	03/21/2022 10:14 AM	College Approval
Revision Requested	Hilty,Michael	08/02/2022 08:03 AM	ASCCAO Approval
Submitted	Hamilton,Ian M	12/15/2022 10:19 AM	Submitted for Approval
Approved	Hamilton,Ian M	12/15/2022 10:20 AM	Unit Approval
Approved	Vankeerbergen,Bernadette Chantal	01/13/2023 12:32 PM	College Approval
Pending Approval	Cody,Emily Kathryn Jenkins,Mary Ellen Bigler Hanlin,Deborah Kay Hilty,Michael Vankeerbergen,Bernadette Chantal Steele,Rachel Lea	01/13/2023 12:32 PM	ASCCAO Approval

10 November 2022

Re: ES/EEOB/Hist 2911: The Climate Crisis
Dear Lived Environments, Sustainability, and Interdisciplinary Team-Teaching committees,

Thank you for reviewing our initial proposal submissions to your committees. In the attached materials, we address each suggestion or comment raised by your three committees. Our revised syllabus seeks approval for Autumn 2023 and addresses the comments raised by your committees. Furthermore, we have pasted your comments below this cover letter and responded in detail to each comment noting where in the syllabus we have made the relevant amendments. These amendments are indicated on the syllabus in RED font.

Thank you for considering our proposals,

Sincerely,

Jim Hood
John Brooke
Matthew Saltzman
Jim Harris
Mike Bevis

High-Impact Practice: Interdisciplinary Team-Teaching

Committee statement: was not voted on as the Panel would like the following feedback items addressed:

- The reviewing faculty thank the course proposer(s) for a thoughtful proposal. However, in its current form, they are unable to approve this course for the High-Impact Practice as it does not succeed in meeting the Integrative, Interdisciplinary Specific Objectives for the category. Please see the document here for further information on the category and its expectations: https://oaa.osu.edu/sites/default/files/uploads/general-education-review/new-ge/interdisciplinary-team-courses-description-expectations.pdf
    - While they acknowledge that the course is being co-taught, in order to count within the Interdisciplinary Team-Teaching category, a course must establish that an interdisciplinary co-teaching style will be developed and introduced, as defined by the Office of Academic Affairs. For example,
        - "In multidisciplinary courses, faculty present their individual perspectives one after another, leaving differences in underlying assumptions unexamined and integration up to the students. In interdisciplinary courses, whether taught by teams or individuals, faculty interact in designing a course, bringing to light and examining underlying assumptions and modifying their perspectives in the process. They also make a concerted effort to work with students in crafting an integrated *synthesis* of the separate parts that provides a larger, more holistic understanding of the question, problem or issue at hand. Smith's iron law bears repeating: 'Students shall not be expected to integrate anything the faculty can't or won't' (quoted in Gaff, 1980, pp. 54-55). (Klein & Newall, 12)."

We believe that the study of climate change inherently requires an interdisciplinary approach which involves, at least, an understanding of the fundamental biogeochemistry of climate change mechanisms, the history of interactions among humans, energy and economies, and the climate, and the biology/ecology of climate change impacts. No single aspect of this field can be taught or understood without an interdisciplinary understanding and synthesis by the course instructors.

When this course was initially designed in 2015 by faculty in Earth Sciences (Bevis), EEOB (Rissing), and History (Brooke, Parker, and White), a core mission was to ensure that it provides students with a clear interdisciplinarity perspective on the climate crisis. Since 2015, the course integration has been regularly renewed with ongoing weekly meetings of the teaching faculty (now including Saltzman in Earth Sciences and Hood in EEOB, and Harris who will join from History in 2023) and teaching associates, and a constant flow of email exchanges, all aimed at ensuring the course includes a clear synthesis and understanding of the issues involved in the science and experience of the rapidly evolving field of climate change for the students throughout.

The team-teaching inventory has been modified and expanded on the 2nd page to include more explicitly the involvement of faculty from all three disciplines in the course.

- "A team-taught course requires that two or more faculty from different disciplines, programs or departments develop and offer a course together.
- Team-taught courses must be taught collaboratively by faculty who integrate distinctly separate disciplines, model interdisciplinary academic exchange, and demonstrate the interdisciplinary nature of the course. This includes explicitly synthesizing across and between the disciplines that each instructor brings to the team-taught, interdisciplinary course."

In the current iteration of the course that we propose for the High-Impact Practice of the New GE, faculty instructors and teaching associates are drawn from three different departments, and work together to generate a synthetic framework of the physical science and biogeochemistry of climate change mechanisms, the history of climate-energy-economic interactions, and the biology/ecology of climate change impacts. While this course is taught in discrete sections, instructors regularly and explicitly dialogue with and build on material presented by other lecturers towards a synthesis of climate change content that relates to human and natural systems. Content that models interdisciplinary exchange is explicitly signaled for the students by the lecturer teaching on a given day, and the lecturer will always make clear how a given slide/subject is either 1/ building on content/disciplinary perspective presented by a colleague or 2/ establishing a foundation for a future lecture/discipline to engage with. In addition, all faculty and TAs are present at ALL lectures throughout the course as well as the meetings of Teaching Associates related to Recitation section planning.

In our syllabus, we have included new language (on page 12-13) to our students in which explicate how this course offers this synthesis and dialogue across the disciplines:

Interdisciplinary nature of the course and how multiple perspectives will be presented and discussed:

The study of climate change requires an interdisciplinary approach which involves, at least, an understanding of the fundamental physics and biogeochemistry of climate change mechanisms, the history of interactions among humans and the climate, and the biology/ecology of climate change impacts. In this course, there are numerous reoccurring themes which we develop and synthesize over the course of the semester to address these interactions including: (1) the carbon cycle, (2) interactions between economies, energy, and climate change, (3) interactions between humans, ecosystems, and the climate. All of these themes require a holistic understanding of the relationship between geophysical, ecological, and historical phenomenon, thus this course draws on the expertise of faculty from all three fields. Indeed, no single aspect of climate change can be taught or understood without an interdisciplinary understanding and synthesis developed from perspectives across the three disciplines. The team of instructors will examine underlying assumptions of the relationship between climate change science, human economies, impacts and mitigation. Furthermore, the instructors will work with the students in creating an integrated synthesis of each course component to provide a holistic understanding of climate change.

This interdisciplinary perspective is established in the lectures, recitations, and the final project:

In lectures:

- Course materials are presented in four logical and sequential structured sections: (1) Mechanisms: climate systems and greenhouse gas cycles; (2) Economies, energy, and climate: an historical overview; (3) Modern climate change impacts; and (4) Mitigating and adapting to climate change. While the first three sections are *primarily* led by individual faculty in the geosciences (section 1), history (section 2), and ecology (section 3), and the fourth section is co-led by the faculty, throughout the course the other two faculty often contribute lectures in support of that theme in the various sections to explicitly synthesize across and between the disciplines that each instructor brings to the course. For example:

- after the Earth Science professor introduces the geophysics necessary to understand the mechanisms of climate change, the EEOB professor teaches students about how variation in the Earth's climate has been and is influenced by the greenhouse effect and global carbon and methane cycles. This includes an exploration of linkages between greenhouse gasses and climate spanning from the origin of life on Earth (~3.7 billion years ago) to the dominant sources of greenhouse gasses in the present day.
- In Section 2, the history professor develops and establishes support for the hypothesis that modern-day anthropogenic climate change arose because of the strong linkage between economic growth and energy production using fossil fuels that emerged through multiple waves of energy transitions. This hypothesis builds upon and requires an understanding of the geophysical mechanisms of climate change developed in Section 1 and prepares students for section 3 and 4, in which the EEOB instructor presents the consequences of these human historical actions.
- In Section 3, the History and EEOB professors together examine how the use of fossil fuels (i.e., using ancient carbon as an energy source) have influenced the climate and will influence modern issues such as human health, food security, and biodiversity.
- In Section 4, all professors examine present and future policy scenarios associated with adapting to climate change and mitigating climate change by decoupling energy production using fossil fuels from economic growth. The course ends with a roundtable discussion in which the instructors integrate the material presented in the final section using the most current scenarios because the development of climate change policy and implementation of solutions change every day in countries across the world.
    - Additionally, all faculty members attend all the lectures where they are able to contribute to the theme of the lecture and are available to offer their perspective and insight.

In Recitation:

- Students work in four-person recitation groups which intentionally combine students from multiple disciplines (e.g., biology, earth science, history, and engineering). Recitation activities are used to further develop and guide students through an interdisciplinary synthesis in this theme. For example:
- Three recitations focus on linkages among economic development, energy transitions, and the climate (Weeks 6, 7, and 15). In these recitations, we ask students to develop conceptual models of how these three factors are coupled and then use them to conduct simulations exploring different development scenarios for past, present, and future human populations.
- Two recitations (Weeks 11 and 12) focused on food production and climate change and explore the linkages between climate change, food production, and human choices that bridge human historical phenomenon and the ecological framework in which human dietary systems operate.

Final projects:

- Final projects provide students with an opportunity to conduct research into a topic of interest to them related to this course. These projects often take an interdisciplinary perspective as they are the result of the collective interests of the recitation groups.

"Teaching partners are expected to collaborate on defining the objectives for the course, putting together the course materials, conducting the formal instruction of students, and evaluating student performance. Note that courses in which one faculty member of record convenes the

course and invites one or more guest speakers to take part in the class are not considered team-taught courses."

Each year, faculty from these three departments collaborate on revising and teaching this course, including synthesizing the latest developments in rapidly evolving field of climate change. All faculty are involved in planning both recitations and lectures and attend all lectures. During each lecture, all faculty are available to address student questions. Our course Teaching Associates are drawn from all three departments to reinforce the interdisciplinary nature of this course and support our synthesis. Faculty and Teaching Associates meet weekly to discuss the interpretive goals of each section of the course.

- The reviewing faculty request a cover letter be submitted that details any changes made in response to the feedback provided by the Panel.

Done

GE Theme: Sustainability

Committee statement: Was unanimously approved with the following six contingencies and two recommendations:

Thank you.

- **Contingency:** The reviewing faculty are very supportive of this course's inclusion within the GE Theme: Sustainability. However, they have concerns that the course's connection to Sustainability will not be entirely clear to students. For example, the description of how the course will meet the Sustainability GE Goals and ELOs (on page 9 of the syllabus) states that students will be able to calculate their ecological footprint and then explores ways to reduce it, but this is not supported in the course calendar within the syllabus. They ask that the connection to Sustainability be further explained within the course syllabus, and especially the schedule, to be clear to students how they can plan to engage with the concept of Sustainability.

We have added new text explaining how this course covers sustainability and addresses the Sustainability Theme goals (page 10-11). In this section, to make the importance of sustainability especially clear to the students we stress that issues associated with sustainability are fundamental to climate science. We spend significant time discussing how emission scenarios in the newest IPCC report (6th edition) now incorporate sustainability scenarios that stress the interaction of economies and emissions (i.e., the Representative Concentration Pathway [RCP] scenarios have been replaced with Shared Socioeconomic Pathways [SSP]).

In the course schedule, we have changed the titles of the first lecture and Section 4 to make it clear that we are explicitly addressing aspects of sustainability in those sections. We have also made explicit that that the recitation activity in week 11 (in which the students calculate their ecological footprint and the ways to reduce it) is very much a question of sustainability. In this exercise, students discover that to sustain a population in which everyone lives like that do, we would require multiple planet Earths to sustain our entire global population.

We do not add more references to sustainability throughout the schedule because sustainability, which is inexorably linked with climate change (touching on aspects of impacts, mitigation, and adaptation), is so pervasive in course materials. To further highlight it in the schedule would

require the syllabus to be utterly overwhelming for the students. But for the committee's clarification we would note that a major theme in Section 2: Economies, Energy, and Climate is the coupling among human development, economic growth, and fossil fuel consumption. Section 2 is focused on the issue of energy transition in the human past, setting the stage for our consideration of the renewable energy transition now under way. At multiple points in this section, we address the fact that breaking the linkage between economic growth and fossil fuel consumption – and advancing the renewal transition -- is central to sustainable growth. Many other lectures have significant subcomponents that deal with topics in sustainability (e.g., lectures on Sept. 9th, Sept. 16th, Oct. 26th, Oct. 28th, Nov. 16th, Nov 18th). For example, the Nov 16th and 18th lectures address how climate change (as well as over-exploitation) has and will influence agriculture, fisheries, and food production systems. We examine the inequity of climate change effects on the global distribution of food production and food insecurity, options for dealing with these issues (i.e., how to make food production more sustainable), as well as how climate change might influence human migrations and how those migrations might feedback on sustainable growth.

- **Contingency:** The reviewing faculty would like to see the language of Sustainability be included within the final project of the course (as discussed on page 4 of the syllabus) as currently it does not make any explicit reference to Sustainability and they worry that it will not be clear to students that they will engage with the topic when completing these projects.

We have added a statement (now on page 3-4) that states: "The project will relate to Sustainability through the six dimensions of sustainability, including human and natural systems, Earth and environmental sciences, and economy and governance, as well as Lived Environments. Your TA can offer guidance on how to approach these topics in your final project."

  - Additionally, they would like to see, in the course schedule (perhaps during the first class session), acknowledgement of the concept of Sustainability and how it will be connected to climate change throughout the rest of the course to ground the students in this idea.

We agree that this is a good idea and will now incorporate that information into our first lecture. To communicate that, we have changed the title of that lecture from "Introduction to the course: questions, structure, and goal [ALL]" to "Overview of climate change past & present and the path to a sustainable future [ALL]"

- **Contingency:** The reviewing faculty ask that the following exclusions be updated in the curriculum.osu.edu submission forms for their respective departments:
  - History 2911: Please add to the exclusion list History 1911.
  - EEOB 2911: Please add to the exclusion list EEOB 1911.

Thank you. These exclusions are updated in the submissions in curriculum.osu.edu for ES/EEOB/HS 2911.

- **Contingency:** The reviewing faculty ask that, on page 7 of the course syllabi, the language that states the Legacy GE categories are for students "Prior to Autumn 2022" be amended and clarified to inform students that these are requirements for them if they are on the Legacy GE program. The reviewing faculty worry that this could cause confusion

to students, especially to those currently enrolled and on the Legacy GE program or transfer students who opt-into the Legacy GE program.

This now reads: For students on the Legacy GE this course… (page 8)

- **Contingency:** The reviewing faculty ask that the following copy and paste errors in the New GE language of all three syllabi be corrected (which can be found on pages 8-10 of the syllabus):
    - On pages 8-9, the ELOs are the same for Sustainability and Lived Environments and it is recommended that the correct ELOs be listed for the respective Theme categories (and can be found on ASC Curriculum and Assessment Services website at:https://asccas.osu.edu/new-general-education-gen-goals-and-elos).
    - The Goals and ELOs for the Citizenship for a Diverse and Just World (as found on page 10 of the syllabus) mention studying "Sustainability".

These errors have been corrected. The Goals and ELOs for the Citizenship GE have been removed.

- **Contingency:** The reviewing faculty request a cover letter be submitted that details any changes made in response to the feedback provided by the Panel.

Done

- **Recommendation:** The reviewing faculty recommend updating the out-of-date Title IX statement (as found on page 7 of the syllabi). The most up-to-date version of the Title IX syllabus can be found on the ASC Curriculum and Assessment Services website at: https://asccas.osu.edu/curriculum/syllabus-elements.

Updated (page 7)

- **Recommendation:** The reviewing faculty recommend clarifying the grading section (as found on page 3 of the syllabi) of the syllabi, as currently the percentage points do not seem to total 100% in its current form. Specifically, it appears that an additional 5% is added to the "Top Hat lecture questions", as the "Lecture" section adds up to 65% and not 60% as stated.

This has been corrected.

GE Theme: Lived Environments.

Committee statement: Was unanimously approved with the following five contingencies and two recommendations:

Thank you.

- **Contingency:** The reviewing faculty understand and made the necessary connections in the course proposal between the idea of Lived Environments and the course materials provided. However, they worry that students (who are non-content experts) will be unable to distinguish the difference between Lived Environments and Sustainability. They kindly request that, in the course syllabi, the language of Lived Environments be further clarified and more clearly connect itself to the GE Theme: Lived Environments

while providing context about how this Theme category is separate from the Sustainability category.

We have revised the paragraph following the Lived Environment goals (page 12) to more explicitly describe how course material addresses the Lived Environment theme. The Lived Environment and Sustainability themes are deeply related to one-another, as understanding how humans have existed in our lived environments past and present provides critical foundations for establishing a sustainable future. Throughout the course we stress the essence of the problem of "lived environments": human consumption of energy, whether by hunter-gatherers, premodern farming communities, or modern economies, is situated in a global environmental context governed by climate systems. Thus, we devote considerable time to exploring the economic-climatic relationships of human societies past and present, and the causes and consequences of energy transitions that drive these economies, and the way in which modern fossil-fuel emissions have created fundamentally unsustainable future. Thus, students must understand the past and present of Lived Environments to appreciate how to create a, hopefully, more sustainable future lived environment. In the syllabus, we explain to students how sections 2 and 3 examine "examples of human interaction with and impact on environmental change and transformation over time and across space" in human interactions with the climate system and the present and future environment we are creating. In sections 1 and 4 we focus on the both the biogeophysics global and national politics of climate change, and what needs to be done to achieve a safe, sustainable future.

- **Contingency:** The reviewing faculty ask that the following exclusions be updated in the curriculum.osu.edu submission forms for their respective departments:
    - History 2911: Please add to the exclusion list History 1911.
    - EEOB 2911: Please add to the exclusion list EEOB 1911.

Thank you. These exclusions are updated in the submissions in curriculum.osu.edu for ES/EEOB/HS 2911.

- **Contingency:** The reviewing faculty ask that, on page 7 of the course syllabi, the language that states the Legacy GE categories are for students "Prior to Autumn 2022" be amended and clarified to inform students that these are requirements for them if they are on the Legacy GE program. The reviewing faculty worry that this could cause confusion to students, especially to those currently enrolled and on the Legacy GE program or transfer students who opt-in to the Legacy GE program.

This now reads: For students on the Legacy GE this course… (page 8)

- **Contingency:** The reviewing faculty ask that the following copy and paste errors in the New GE language of all three syllabi be corrected (which can be found on pages 8-10 of the syllabus):
    - On pages 8-9, the ELOs are the same for Sustainability and Lived Environments and it is recommended that the correct ELOs be listed for the respective Theme categories (and can be found on ASC Curriculum and Assessment Services website at:https://asccas.osu.edu/new-general-education-gen-goals-and-elos).
    - The Goals and ELOs for the Citizenship for a Diverse and Just World (as found on page 10 of the syllabus) mention studying "Sustainability".

These errors have been corrected. The Goals and ELOs for the Citizenship GE have been removed.

- **Contingency:** The reviewing faculty request a cover letter be submitted that details any changes made in response to the feedback provided by the Panel.

Done

- **Recommendation:** The reviewing faculty recommend updating the out-of-date Title IX statement (as found on page 7 of the syllabi). The most up-to-date version of the Title IX syllabus can be found on the ASC Curriculum and Assessment Services website at: https://asccas.osu.edu/curriculum/syllabus-elements.

Updated (page 7)

- **Recommendation:** The reviewing faculty recommend clarifying the grading section (as found on page 3 of the syllabi) of the syllabi, as currently the percentage points do not seem to total 100% in its current form. Specifically, it appears that an additional 5% is added to the "Top Hat lecture questions", as the "Lecture" section adds up to 65% and not 60% as stated.

This has been corrected

EARTH SCIENCE/EEOB/HISTORY 2911: The Climate Crisis

An interdisciplinary course offered jointly by the Departments of Earth Sciences, Evolution, Ecology and Organismal Biology and History

Autumn 2023

Lectures: Tuesday/Thursdays TBD
Room TBD

Recitations: TBD
Mendenhall Laboratory Room 163

Course Description
This course provides a multidisciplinary introduction to the causes of climate change, its consequences for Earth, life, and society, and what we can do about it. This course was developed and will be taught by a team of professors and teaching associates from geoscience, biology, and history. Students will acquire insights from all these disciplines to address the most critical issue of our time. No background in the natural or social sciences is required, other than those described in the Ohio (and most other state) K-12 content standards.

Instructors:

Prof. Michael Bevis, School of Earth Sciences, 275 Mendenhall Lab, bevis.6@osu.edu (247-5071)
Office hours:

Dr. Jim Harris Department of History, 368 Dulles Hall, Email: harris.1631@osu.edu
Office hours:

Prof. Jim Hood, Department of Evolution, Ecology and Organismal Biology, 230 Research Center. hood.211@osu.edu (292-5383)
Office hours:

All recitations meet in Mendenhall Lab, 163

Recitation Staff:
TBD (Earth Science)

TBD (History)

TBD (EEOB)

ALL Students enrolled in EARTHSC/EEOB/HIST 2911: Note that the course hours earned in this class do not count as upper-division hours required for graduation.

Some important information in this course:
Lectures will have a Top-Hat component, which will determine your participation grade, so you will need attend the lecture in person at the scheduled time. Recitations will be in person, all in Mendenhall Lab 163, a large room. They will have graded components that will require participation at the scheduled time. Please see details below, and the "Course technology" section on the last page.

We will be making announcements on Carmen and copying these announcements into emails to the class. Please regularly check your Carmen page for announcements. Currently all office hours will be held via Zoom.

Please put the course number (EEH 2911) in any emails that you send to us. We get a lot of messages, and we teach more than one course!

Course Readings
All required readings, or links to them, will be posted to Carmen. There is no ***required*** textbook for the course.

Course Assignments and Grading

For this course is calculated on a 1000-point scale, corresponding to 100% of your grade:

Lecture Content 60% [600 pts]	Top Hat participation questions: 120 pts Section Exams: 480 pts (Exam 1 = 120, Exam 2 = 120, Exam 3 = 240)
Recitation Participation 20% [200 points]	Pre-Reports: 10 points * 11 recitations = 120 pts Group Reports: 6-9 points * 11 recitations = 80 pts
Final Project 20% [200 pts]	Newspaper Articles and Comments: 20 points * 3 each = 60 pts Paper or PowerPoint Prospectus: 20 pts Final Paper or PowerPoint Presentation: 120 pts
TOTAL: 100%	**1000 pts Possible**

Major assignment due dates:
Unit exam, Section 1: Mechanisms Sept. xx
Unit exam, Section 2: Economies, energy Oct. xx
Paper or PowerPoint Prospectus due in recitation Nov. xx, xx
Unit exam, Section 3&4: Mitigation Dec. xx

Papers, by students who have chosen this option, are due on Carmen, Friday, Dec. xx, by 6:00PM
PowerPoint project option are due on Carmen Friday Dec. xx, by 6:00PM
PowerPoint presentations will take place on Friday Dec. xx, 4:00-6:00PM. [Note: this is our exam day and time, so there should be minimal conflicts.]

Lecture questions and unit exams
There will be short sets of questions during the lectures, delivered via Top-Hat. The first few questions (presented at start of class so please arrive on time) will be worth 0.5 accuracy points and 0.5 participation points. The remaining questions will be worth 1 participation point.

There will be three unit exams on Sept. xx, Oct. xx, and Dec. xx. You will have eighty minutes to complete each exam during the regular class meeting time. If you are unable to take the exam during the regular class time, you will need to make alternative arrangements by 5pm on the day before the exam (Sept 19, Oct 10, Dec 8). Unit-exam questions will focus on material covered in current lectures and readings; however some key material will be cumulative. Exams include a combination of multiple choice and short answer questions.

Recitation Participation
The Recitations will be conducted in person in Mendenhall Labs, Room 163, at the scheduled times. We expect our students to attend and participate in all scheduled recitation sections, having read all assigned readings for that week, and to participate regularly in the discussions taking place in these recitations. Recitations will be divided into four-person pods, which will work together throughout the course. Grades will be assigned to your participation in both "Pre-reports" (individual comments posted to Carmen before recitation); and "Group reports" (commentary posted to Carmen by your assigned Group, at the end of recitation).

Newspaper Articles and Discussion
Elements of several of the earlier recitation sections will be built around the formation and discussion of electronic news article "scrapbooks." Students are expected to contribute three articles to their recitation-pod scrapbook. Submissions should be accompanied by a paragraph explaining the content, why you found the article particularly important or compelling, and how it relates to the course. Regular submission of appropriate articles from major respectable news sources will earn full credit for this portion of the course grade. Please see the instructions on Carmen for further details.

Final project:
There will be **two options for a final project**: a group-developed PowerPoint presentation or a short individual research paper. Building from the course material, the newspaper article collections developed in the recitation groups, and your own research, papers or PowerPoints will explore a particular dimension of the wider problem of climate change past, present, and future, appropriately informed by the geophysics, biology, and/or history of climate change. The

project will relate to Sustainability through the six dimensions of sustainability, including human and natural systems, Earth and environmental sciences, and economy and governance, as well as Lived Environments. Your TA can offer guidance on how to approach these topics in your final project.

Option A: PowerPoint Project.
EEH2911 PowerPoint Projects option offer you the opportunity to work in small groups, exploring a particular dimension of the wider problem of climate change past, present, and future, appropriately informed by the geophysics, biology, and/or history of climate change. Your PowerPoint group will be drawn typically from your recitation pod. The PowerPoint groups will distribute the research and production responsibilities equitably, and specify them in the Poster Prospectus, which are due for review in recitation on Nov. x, x. The project involves two required steps: (1) a prospectus; (2) a delivered PowerPoint, turned in on Carmen on Dec. xx and presented on Zoom by all members of the group to a team of instructors on Dec. xx. Part of the grading will be based on the effectiveness of the PowerPoint group teamwork. Further information can be found in "Research Guidelines" the "PowerPoint Instructions" posted to the course Carmen site.

Option B: Individual essay.
Alternatively, you may write an essay of ~1,200 words with citations, exploring a particular dimension of the wider problem of climate change past, present, and future, appropriately informed by the geophysics, biology, and/or history of climate change. Your papers should be informed by the course material, the newspaper article collections developed in the recitation pods, and your own research. Your Paper Prospectus is due for review in recitation on Nov. x, x. Your paper will be due on December xx. Further information can be found in "Research Guidelines" the "Essay Instructions" posted to the course Carmen site.

Grading scale:

A	93-100	C+	77-79.9
A-	90-92.9	C	73-76.9
B+	87-89.9	C-	70-72.9
B	83-86.9	D	60-69.9
B-	80-82.9	E	0-59.9

Faculty feedback and response time
(Remember that you can call **614-688-HELP** at any time if you have a technical problem with Carmen. Please the last page for "Course Technology".)

- **Grading and feedback:** For major assignments, you can generally expect feedback within 10 **days**. Recitation grading generally will be available in at least 48 hours.

- **Email:** We will reply to emails within **24 hours on days when class is in session at the university**.

Course Policies

Attendance:
The lectures will be conducted in person, with Top-Hat mini-quizzes, open mike sessions, and question periods initiated by TA monitored chat functions. Participation in these activities, especially the Top-Hat mini-quizzes, is calculated into your lecture attendance grade. If you will be missing the scheduled lecture and have a valid excuse (medical, COVID19-related, or compassionate reasons only), please inform your TA, and you will have access to a Carmen quiz following viewing the recorded lecture you will be provided with a makeup assignment for the participation points and mini-quizzes. While we appreciate that life may conflict with lecture every once in a while, particularly during these turbulent and difficult times, double-booking another regularly scheduled event (e.g., a different class, exam, or work) with lecture will not be excused.

The recitation in this course employs structured, cooperative groups for many graded activities; absence of a group member can harm group members attending recitation. Therefore, all students should complete the course readings and other activities and attend every lecture and their scheduled recitations. Class meetings will usually include in-class assignments and quizzes, so missing class will lower your grade.

You should attend the recitation section in which you are enrolled. If you miss or know you will miss your assigned recitation section (e.g. for a scheduled health care appointment), and can attend an earlier or later section, work with your TA to arrange attending the other section. Note, this will disrupt interactions with your cooperative group, and we will try to minimize how often it occurs.

Submitting Work: Please submit all assignments in a MS Word compatible format (.doc, .docx, .txt., or .rtf) online on Carmen. Work will not be considered complete until it is has been uploaded in a readable format. If we cannot read it, we cannot grade it or even comment on it.

Late Work: Late assignments will have 10% deducted for every day late, weekends included. The only exceptions will be extensions granted ahead of time or serious documented emergencies.

Statement on Plagiarism and Misconduct: OSU has a strict code of academic misconduct that requires us to report any and all cases of suspected misconduct (e.g., plagiarism in written assignments, etc.) to the OSU Committee on Academic Misconduct for adjudication.

It is the responsibility of the Committee on Academic Misconduct 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/.

We adhere to this policy. You should understand the nature and consequences of plagiarism (and of anti-plagiarism sites like www.turnitin.com). The OSU Writing Center: http://cstw.osu.edu provides more information on proper citing of your sources of information.

Grade Grievances and Other Academic Complaints: Students with complaints about courses, grades, and related matters should first bring the matter to one of the instructors.

> Students enrolled in EARTHSC 2911 or EEOB 2911*:* If the student and the instructor cannot arrive at a mutually agreeable settlement, the student may appeal further to the College of Arts and Sciences. For additional information see the Office of Undergraduate Education (https://ugeducation.osu.edu/complaint-grievance-and-appeal-procedures/) and the Office of Student Life: Student Advocacy Center (https://advocacy.osu.edu/academic-enrollment/grade-grievance/).
>
> Students enrolled in HIST 2911: *Dept. of History Grievance guidelines:* If the student and the instructor cannot arrive at a mutually agreeable settlement, the student may take the complaint to the vice chair of the department, David Brakke (.2), who will investigate the matter fully and attempt to resolve it. If the vice chair is involved, the student should contact the department chair, Scott Levi (.18). The student may appeal further to the College of Arts and Sciences. Any student with a grievance may seek advice from the department's grievance resource officer, Birgitte Soland (.1).

University and course policies:

Disability Services

The University strives to make all learning experiences as accessible as possible. In light of the current pandemic, students seeking to request COVID-related accommodations may do so through the university's request process, managed by Student Life Disability Services. If you anticipate or experience academic barriers based on your disability (including mental health, chronic or temporary medical conditions),

please let me know immediately so that we can privately discuss options. To establish reasonable accommodations, we may request that you register with Student Life Disability Services. After registration, make arrangements with us 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; 098 Baker Hall, 113 W. 12th Avenue.

Statement of 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 through the 24/7 National Suicide Prevention Hotline at 1-800-273-TALK or at suicidepreventionlifeline.org.

Statement on 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.

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

Statement on Counseling Services: Should you find yourself experiencing personal difficulties, whether related to class or not, please know that you have access to confidential services

provided by the University. Details can be found here https://safeandhealthy.osu.edu/mental-health-wellness.

Land Acknowledgement: The Ohio State University acknowledge that its campuses have long served as sites of meeting and exchange for Indigenous peoples, including those in historical times known as the Shawnee, Miami, Wyandotte, Delaware, and the People of Fort Ancient, Hopewell, and Adena cultures, also known as the earthworks builders, as well as other tribal nations of the region. The Ohio State University honors and respects the diverse Indigenous peoples connected to this land in which we gather.

GENERAL EDUCATION

For students on the Legacy GE this course may fulfill any one of the following: GE Historical Study, GE Natural Science: Biological Science, GE Natural Science: Physical Science.

Physical and Life Science Learning Goals:
1. Students understand the basic facts*, principles, theories and methods of modern science.
2. Students understand key events in the development of science and recognize that science is an evolving body of knowledge.
3. Students describe the inter-dependence of scientific and technological developments.
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.

Rationale for Meeting Physical and Life Science Learning Goals:
1. We will examine the basic facts, principles and theories of climate, climate change and climate change impacts, both from physical and biological perspectives. This includes a study of scientific methodology.
2. Much of the scientific content of this course will be organized around the history of the related observational and theoretical advances, and the progressive development of the modern understanding and the predictive power of climate change science.
3. Climate change is largely driven by human practices tied to our energy technologies and industries and our need for resources such as food, space and raw materials. Scientific investigation has helped diagnose the problem, and identify solutions: these solutions will involve the development and large-scale deployment of new technologies.
4. Climate change is one of the most important and critical issues facing the contemporary world. It exemplifies the 'unintended consequences' of science and technology, as they have been developed and deployed in the global economy. The spatially and socially uneven impacts of global change also raise important moral, legal, social and political issues. Science and technology have contributed to climate change but can also be part of the solution.

History Learning Goals:
History courses develop students' knowledge of how past events influence today's society and help them understand how humans view themselves.
1. Students acquire a perspective on history and an understanding of the factors that shape human activity.
2. Students display knowledge about the origins and nature of contemporary issues and develop a foundation for future comparative understanding.
3. Students think, speak, and write critically about primary and secondary historical sources by examining diverse interpretations of past events and ideas in their historical contexts.

Rationale for Meeting History Learning Goals:
1. Students will explore past climate changes and how they influenced human economies, societies, and cultures.
2. Students will learn about the technological, business, and political developments that led to contemporary global warming and have obstructed political responses.
3. Students will read and discuss original historical accounts documenting climatic changes and impacts.

New GE Theme Goals & ELOs
This course may fulfill one of either of the following GE Themes

Sustainability:
GOALS:

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

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.

3. Successful students will analyze and explain how social and natural systems function, interact, and evolve over time; how human well-being depends on these interactions; how actions have impacts on subsequent generations and societies globally; and how human values, behaviors, and institutions impact multifaceted potential solutions across time.

EXPECTED LEARNING OUTCOMES:

Successful students are able to:

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

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

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

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.

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

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, present, and future.

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.

How this course addresses the Sustainability Theme goals:

Sustainability is a central topic in this course, following the newest IPCC report (6th edition) which now incorporates sustainability scenarios modeled as Shared Socioeconomic Pathways [SSP]). In this course, students engage with issues of sustainability through lectures, recitations, and their final project. Lectures explore the interconnections between human activities, climate change, and the environment in the past (looking at paleo- and historical records of the climate and human-climate interactions), present (how human-climate interactions have influenced human and environmental well-being), and future (how climate model forecasts are influenced by whether growth is sustainable or not). We also examine how past and present human interactions with the natural world have shaped the modern climate crisis (altering the carbon cycle through increased emissions as our demand for energy increases) as well as the potential for generations-long impacts on societies in the future. At the end of the semester, we consider how we can make our energy systems more sustainable to mitigate further danger to future generations by examining renewable energy options, particularly in light of the new legislation (Inflation Reduction Act of 2022) that represents the largest investment in U.S. history to transition the country away from a carbon-based economy. In recitations, students will explore these issues in greater depth and begin to analyze and critique how human activities (whether sustainable, not sustainable, or something in between) influence human and environmental well-being. For example, one group of recitations (Week 6 and 7) challenges students to generate simulations exploring how energy transitions (e.g., wind to coal to renewable energy) could influence the climate as well as human well-being and sustainability. In another recitation, students calculate their ecological footprint - similar to the carbon footprint - and explore sustainable ways to reduce their ecological footprint (Weeks 10 and 11). The final project allows students to engage in an advanced, in-depth exploration of topics in sustainability if they choose.

Lived Environments:
GOALS:

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

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.

3. Successful students will explore a range of perspectives on the interactions and impacts between humans and one or more types of environment (e.g., agricultural, built, cultural, economic, intellectual, natural) in which humans live.

4. Successful students will analyze a variety of perceptions, representations, and/or discourses about environments and humans within them.

EXPECTED LEARNING OUTCOMES:

Successful students are able to:

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

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

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

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.

3.1. Engage with the complexity and uncertainty of human-environment interactions.

3.2. Describe examples of human interaction with and impact on environmental change and transformation over time and across space.

4.1. Analyze how humans' interactions with their environments shape or have shaped attitudes, beliefs, values, and behaviors.

4.2. Describe how humans perceive and represent the environments with which they interact.

4.3. Analyze and critique conventions, theories, and ideologies that influence discourses around environments.

This course fulfills these Lived Environments Theme goals:

This course invites students to develop both scientific and humanities-based approaches to understanding the place of humanity in the web of natural and built environments, through a close examination of the structure, history, and future of the human relationship with the Earth's climate systems. Taking a deep-time approach, this course situates humanity within the larger Earth system in order to demonstrate how, for much of human history, humans have been at the mercy of environmental forces, which have shaped their lived experiences, beliefs, and behaviors (e.g., where they settled, how they fed themselves, etc.) in order to show how human lives are environmentally embedded. Yet, in the recent past, humans have been increasing able to overcome these environmental checks and challenges, especially through the fossil fuel revolution in the last several hundred years (a mere blip in the grand scheme of geological time and evolutionary history). In the very recent past, new human demographics and economies have altered the nature of the relationship between humans and their environment in profound ways and this is certainly clear in global climate dynamics. Section two of this course in particular invites students to analyze this transformation in both deep-time and modern perspective. Along the way, students will consider how human attitudes toward their environments have become increasingly callous, creating the modern climate crisis. Then, in section 3, we consider how new interactions between humans and the biosphere manifest within the Earth system as a result of these new demographic and energy demands and the consequences of these changes on the natural world and human well-being. By the end of section 3, students come to an understanding of the increasingly blurred boundary between natural and built environments on the planetary scale, as the detrimental effects of human interactions on their lived environments create positive feedbacks intensifying climate change and threatening society and the built environment. Finally, throughout the course, we consider and theorize how and why we have entered a new, if still unofficial, geological epoch, the Anthropocene, made manifest entirely by human actions and what this new relationship looks like.

Interdisciplinary nature of the course and how multiple perspectives will be presented and discussed:

The study of climate change requires an interdisciplinary approach which involves, at least, an understanding of the fundamental physics and biogeochemistry of climate change mechanisms, the history of interactions among humans and the climate, and the biology/ecology of climate change impacts. In this course, there are numerous reoccurring themes which we develop and synthesize over the course of the semester to address these interactions including: (1) the carbon cycle, (2) interactions between economies, energy, and climate change, (3) interactions between humans, ecosystems, and the climate. All of these themes require a holistic understanding of the relationship between geophysical, ecological, and historical phenomenon; thus, this course draws on the expertise of faculty from all three fields. Indeed, no single aspect of climate change can be taught or understood without an interdisciplinary understanding and synthesis developed from perspectives across the three disciplines. The team of instructors will examine underlying assumptions of the relationship between climate change science,

human economies, impacts and mitigation. Furthermore, the instructors will work with the students in creating an integrated synthesis of each course component to provide a holistic understanding of climate change.

This interdisciplinary perspective is established in the lectures, recitations, and the final project:

In lectures:

- Course materials are presented in four logical and sequential structured sections: (1) Mechanisms: climate systems and greenhouse gas cycles; (2) Economies, energy, and climate: an historical overview; (3) Modern climate change impacts; and (4) Mitigating and adapting to climate change. While the first three sections are *primarily* led by individual faculty in the geosciences (section 1), history (section 2), and ecology (section 3), and the fourth section is co-led by the faculty, throughout the course the other two faculty often contribute lectures in support of that theme in the various sections to explicitly synthesize across and between the disciplines that each instructor brings to the course. For example:
    - after the Earth Science professor introduces the geophysics necessary to understand the mechanisms of climate change, the EEOB professor teaches students about how variation in the Earth's climate has been and is influenced by the greenhouse effect and global carbon and methane cycles. This includes an exploration of linkages between greenhouse gasses and climate spanning from the origin of life on Earth (~3.7 billion years ago) to the dominant sources of greenhouse gasses in the present day.
    - In Section 2, the history professor develops and establishes support for the hypothesis that modern-day anthropogenic climate change arose because of the strong linkage between economic growth and energy production using fossil fuels that emerged through multiple waves of energy transitions. This hypothesis builds upon and requires an understanding of the geophysical mechanisms of climate change developed in Section 1 and prepares students for section 3 and 4, in which the EEOB instructor presents the consequences of these human historical actions.
    - In Section 3, the History and EEOB professors together examine how the use of fossil fuels (i.e., using ancient carbon as an energy source) have influenced the climate and will influence modern issues such as human health, food security, and biodiversity.
    - In Section 4, all professors examine present and future policy scenarios associated with adapting to climate change and mitigating climate change by decoupling energy production using fossil fuels from economic growth. The course ends with a roundtable discussion in which the instructors integrate the material presented in the final section using the most current scenarios because the development of climate change policy and implementation of solutions change every day in countries across the world.
- Additionally, all faculty members attend all the lectures where they are able to contribute to the theme of the lecture and are available to offer their perspective and insight.

In Recitation:

- Students work in four-person recitation groups which intentionally combine students from multiple disciplines (e.g., biology, earth science, history, and engineering). Recitation activities are used to further develop and guide students through an interdisciplinary synthesis in this theme. For example:
    - Three recitations focus on linkages among economic development, energy transitions, and the climate (Weeks 6, 7, and 15). In these recitations, we ask students to develop conceptual models of how these three factors are coupled and then use them to conduct simulations exploring different development scenarios for past, present, and future human populations.
    - Two recitations (Weeks 11 and 12) focused on food production and climate change and explore the linkages between climate change, food production, and human choices that bridge human historical phenomenon and the ecological framework in which human dietary systems operate.

Final projects:

- Final projects provide students with an opportunity to conduct research into a topic of interest to them related to this course. These projects often take an interdisciplinary perspective as they are the result of the collective interests of the recitation groups.

COURSE SCHEDULE

REFER TO THE CARMEN FOR UP-TO-DATE DUE DATES.

Note: Syllabus is subject to limited change with advanced notice. There will be no change in the length and number of assignments.

Week 1
August 24: An overview of climate change past & present and the path to a sustainable future
*No recitations this week

SECTION 1: MECHANISMS: CLIMATE SYSTEMS & GREENHOUSE GAS CYCLES
August 26: Weather and Climate

Week 2
Recitations Aug. 30, Sept. 1: How does the IPCC arrive at recommendations about climate change and what are its most important recommendations?
August 31: Solar radiation and the Greenhouse Effect
September 2: Atmospheric and Oceanic Circulation

Week 3
Recitations: NONE – Labor Day on Monday. Sept. 6
September 7: The Discovery of Global Warming
September 9: Paleoclimatology and the Fragility of the Climate System

Week 4
Recitations Sept. 13, 15: Understanding the Global Carbon Cycle
September 14: Anthropogenic and natural sources of global warming gasses
September 16: ½ GHG cont. [Hood]; ½ The climate system can be saved!

September 20 Monday SECTION 1 EXAM – AVAILABLE ALL DAY; OPEN FOR EIGHTY MINUTES, see unit-exam description on p. 3

SECTION 2: ECONOMIES, ENERGY AND CLIMATE: AN HISTORICAL OVERVIEW
Week 5
Recitations Sept. 20, 22: Poster and essay planning: Discuss the key themes in the EEH2911 student newspaper posts.
September 21: Climate, energy, and humanity: evolutionary origins through the origins of agriculture
September 23: Climate and Crisis: Agriculture, Disease, and Warfare in the [Holocene] Ancient and medieval worlds

Week 6
Recitations Sept. 27, 29: Climate and premodern energy transitions
September 28: The Little Ice Age and the First Globalization: the opening to modernity [Harris]
September 30: Energy and Economies: The First Industrial Revolution

Week 7
Recitations Oct. 4, 6: What have been the key features of the energy transitions since 1800?
October 5: Energy and Economies: The Second Industrial Revolution
October 7: Energy and greenhouse emissions

Monday October 11: SECTION 2 EXAM – AVAILABLE ALL DAY; OPEN FOR EIGHTY MINUTES, see unit-exam description on p. 3

SECTION 3: MODERN CLIMATE CHANGE IMPACTS
Week 8
Recitations: NONE – fall Break [Note: Sect. II Exam on Monday, Oct. 11]
October 12: Emission, economies, and climate change impacts through time; Some thoughts on population growth
October 14: NO CLASS – Fall Break

Week 9
Recitations Oct. 18, 20: Poster and essay planning: preliminary research plan
October 19: Intensification of the Hydrological Cycle
October 21: Ice loss, Water Resources and Seal Level Rise

Week 10
Recitations Oct. 25, 27: How much corn and how many cows can you raise on the oval?
October 26: Background: value of biodiversity & ecosystem services
October 28: Impact of climate change on environmental suitability for nature & people

Week 11
Recitations Nov. 1, 3: What is your ecological footprint? Is it sustainable? **Your PowerPoint or paper prospectus is due in recitation**
November 2: Impact of extreme events: heat waves, fires, and floods
November 4: Effect on biodiversity: extinctions and changes in biogeography and biological timing

Week 12
Recitations Nov. 8, 10: What is the impact of climate change on agriculture in the United States?
November 9: Boreal Forest: impacts and feedbacks

November 11: NO CLASS – Veterans Day

Week 13
Recitations Nov. 15, 17: How do citizens and the policy-makers they elect understand (or not) the science on which to base today's public policies
November 16: Agriculture, fisheries, and food production systems

Friday: 19 Nov: SECTION 3 EXAM – AVAILABLE ALL DAY; OPEN FOR EIGHTY MINUTES, see unit-exam description on p. 3

SECTION 4: TOWARDS A SUSTAINABLE FUTURE: MITIGATING AND ADAPTING TO CLIMATE CHANGE
November 18: Conservation planning for persistence, resistance, and resilience

Week 14
November 23: Renewable Energy, Energy Storage, and Energy Efficiency, Day 1
Recitations: NONE Thanksgiving break starts Nov. 24
November 25: NO CLASS Thanksgiving break

Week 15
Recitations Nov. 29, Dec. 1: What is required to drive the next energy transition?
November 30: Renewable Energy, Energy Storage, and Energy Efficiency, Day 2
December 2: Global Climate Change Politics: Fears, Denial, and Future Scenarios

Week 16
December 7: Can our Climate System be 'Saved'?: A Faculty Panel Discussion
No recitations this week

December 8: Short Final Exam on-line: ***AVAILABLE ALL DAY; OPEN FOR EIGHTY MINUTES, see unit-exam description on p. 3***

Final Assignments:

Option A:
PowerPoint project option is due on Carmen Thursday, Dec 9, by 6:00PM.
PowerPoint presentations will take place during our final exam day and time so there should be minimal conflicts.

Option B:
Papers, by students who have chosen this option, are due on Carmen, Friday December 10, 4:00PM

* We agree with the report of the Special Commission of the National Academy of Sciences that has stated, "Any education that focuses predominantly on the detailed products of scientific labor — the facts of science — without developing an understanding of how those facts were established, or that ignores the many important applications of science in the world, misrepresents science and marginalizes the importance of engineering." (doi.org/10.17226/13165.)

TOP HAT POLICIES AND USAGE

- Access by smartphone or computer web browser. Texting option available as well.
- Sign for a Top Hat account athttps://app.tophat.com/login(do NOT select the SSO bypass option) using your OSU username/password and there is no cost to you.
- Once you have an account, you will be able to enter the join code #984971or search for the course "1911 Fall 2020 Climate Change" to be enrolled.
- It is useful to browse the student support pages athttps://support.tophat.com/s/categoryhome/Student and if you have questions you are encouraged to call Top Hat or email at support@tophat.com.
- Using Top Hat, points are awarded for questions answered correctly in class –in other words, we have daily 'quizzes'.
- There will also be bonus points for participation in class using Top Hat (some questions are opinion or thought questions).
- Accommodation will be made for students with disabilities.

TOP HAT POLICIES AND USAGE: GRADING

- Review questions will be asked during lecture based on material from the previous class (in-class 'quizzes'). There will be about 3 questions per lecture on average, but anywhere from 1-10 is possible.
- For each Top Hat question you answer in class you will get points for the correct answer. But you also get points for any answer (participation). For example, a question answered in class gives 80% for getting it correct and 20% for any answer.
- For each lecture unit, Top Hat points will count for a quarter of your unit lecture point total. For each lecture unit section, the exam will count 15% and Top Hat as 5% (in other words, 15% of your course grade is based on your Top Hat daily quiz points).
- Answers to review questions will be made accessible 'for review' on Top Hat and serve as excellent practice when studying for exams.
- Some Top Hat 'participation only' questions count for bonus points.

Course technology and assistance

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

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

Technology skills specific to this course

- Basic PowerPoint skills for team project

Required equipment

- Computer: current Mac (OS X) 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.

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 the IT support staff will work out a solution with you.

Interdisciplinary Team-Taught Course Inventory

Overview

The GE allows students to take a single, 4+ credit course to satisfy a particular GE Theme requirement if that course includes key practices that are recognized as integrative and high impact. Courses seeking one of these designations need to provide a completed Integrative Practices Inventory at the time of course submission. This will be evaluated with the rest of the course materials (syllabus, Theme Course submission document, etc). Approved Integrative Practices courses will need to participate in assessment both for their Theme category and for their integrative practice.

Please enter text in the boxes below to describe how your class will meet the expectations of Interdisciplinary Team-Taught courses. It may be helpful to consult the Description & Expectations document for this pedagogical practice or to consult your Director of Undergraduate Studies or appropriate support staff person as you complete this Inventory and submit your course.

Please use language that is clear and concise and that colleagues outside of your discipline will be able to follow. You are encouraged to refer specifically to the syllabus submitted for the course, since the reviewers will also have that document Because this document will be used in the course review and approval process, you should be *as specific as possible*, listing concrete activities, specific theories, names of scholars, titles of textbooks etc.

Accessibility

If you have a disability and have trouble accessing this document or need to receive it in another format, please reach out to Meg Daly at daly.66@osu.edu or call 614-247-8412.

Pedagogical Practices for Interdisciplinary Team-Taught Courses

Course subject & number ES/EEOB/HS2911

Performance expectations set at appropriately high levels (e.g. Students investigate large, complex problems from multiple disciplinary perspectives). Please link this expectation to the course goals, topics and activities and indicate *specific* activities/assignments through which it will be met. *(50-500 words)*

In this course, students investigate the large, complex problem of climate change from an interdisciplinary perspective. Students explore the physical basis for climate change, impacts on biological organisms, and the ways in which humans can both adapt to and mitigate climate impacts. The course activities and assignments require synthesis of knowledge from many fields. For example, during one in-class activity students predict how different human societies will respond to future climates by a combination of economic solutions that include physical infrastructure risk mitigation, carbon sequestration and green hydrogen production. The human psychology of decision making about these mitigation strategies, moving on from a carbon-based economy, and risk reduction are part of this predictive exercise.

Significant investment of time and effort by students over an extended period of time (e.g., engage the issue iteratively, analyzing with various lenses and seeking to construct an integrative synthesis). Please link this expectation to the course goals, topics and activities and indicate *specific* activities/assignments through which it will be met. *(50-500 words)*

In this course, students investigate the large, complex problem of climate change from an interdisciplinary perspective. Students explore the physical basis for climate change, impacts on biological organisms, and the ways in which humans can both adapt to and mitigate climate impacts. The course activities and assignments require synthesis of knowledge from many fields. For example, during one in-class activity students predict how different human societies will respond to future climates by a combination of economic solutions that include physical infrastructure risk mitigation, carbon sequestration and green hydrogen production. The human psychology of decision making about these mitigation strategies, moving on from a carbon-based economy, and risk reduction are part of this predictive exercise.

Students learn about the physical science drivers of climate change as well as historical aspects of Earth's climate and the impacts on life. They engage iteratively with the science and history of climate change as they integrate aspects of adaptation of biological systems and ultimately mitigation. For example, students learn about climate change skepticism perpetuated by those who profit from the oil and gas industry and compare it to the skepticism over cigarette smoking perpetuated by those who profit from the tobacco industry, they are analyzing this through the lens of science, history, and human dimensions (economics, risk, psychology).

Interactions with faculty and peers about substantive matters including regular, meaningful faculty mentoring and peer support about conducting interdisciplinary inquiry. Please link this expectation to the course goals, topics and activities and indicate *specific* activities/assignments through which it will be met. *(50-500 words)*

The study of climate change inherently requires an interdisciplinary approach which involves, at least, an understanding of the fundamental biogeochemistry of climate change mechanisms, the history of interactions among humans, energy and economies, and the climate, and the biology/ecology of climate change impacts. No single aspect of this field can be taught or understood without an interdisciplinary understanding and synthesis.

Recognizing the interdisciplinary nature of this field of study, faculty from Earth Science, History, and EEOB collaborated on the design of this class in 2015 and have co-taught this course ever since. Each year, faculty from these three departments collaborate on revising and teaching this course, including synthesizing the latest developments in rapidly evolving field of climate change. All faculty are involved in planning both recitations and lectures and attend all lectures.

Students will get frequent, timely, and constructive feedback on their work, scaffolding multiple disciplinary perspectives and integrative synthesis to build over time. Please link this expectation to the course goals, topics and activities and indicate *specific* activities/assignments through which it will be met. *(50-500 words)*

We build an integrative interdisciplinary perspective by weaving together the mechanisms of climate change (earth science and biology), the history of human-climate interactions (history), climate change impacts (all disciplines), and climate change mitigation (all disciplines). Students are supported in their exploration of this topic by recitation exercises which both elaborate on complex concepts (Understanding the global carbon cycle) and support students while they synthesize concepts (What have been the key features of the energy transitions since 1800?). For the course capstone, groups of students prepare a presentation which explores an aspect of climate change from the perspective of multiple disciplines and/or perspectives. Students are scaffolded through this process by newspaper article scrapbooks which support idea generation, brainstorming recitations, and a presentation prospectus all of which receive feedback from the Teaching Assistants.

Periodic, structured opportunities to reflect and integrate learning (e. g. students should work to integrate their insights and construct a more comprehensive perspective on the issue). Please link this expectation to the course goals, topics and activities and indicate *specific* activities/assignments through which it will be met. *(50-500 words)*

Students are given recitation exercises which both explore complicated concepts and motivate them to synthesis and integrate the material they have learned. Most recitations use a jigsaw cooperative learning strategy which allows students to specialize in a topic and then return to a home group to explore how their specialized topics fits together with the other puzzle pieces. These home groups are maintained throughout the semester. Groups are organized to increase the diversity of group members along multiple axes including their major (e.g., an engineer, historian, biologist, and Spanish major). The capstone project presentation offers a semester-long opportunity for the students to integrate and synthesize what they have learned about climate change, in collaboration with their home group, and communicate that information to their peers.

Opportunities to discover relevance of learning through real-world applications and the integration of course content to contemporary global issues and contexts. Please link this expectation to the course goals, topics and activities and indicate *specific* activities/assignments through which it will be met. *(50-500 words)*

Ongoing climate change is humanities greatest current crisis and our global mitigation/ adaptation to this change will affect all spheres of the human endeavor. Students engage with this reality throughout the course. Lectures frequently discus current events (e.g., the latest hurricane or wildfire, climate change legislation, or the U.N. Climate Change Summit) and discuss cutting edge approaches for mitigating/adapting to climate change (e.g., trends in renewable energy technology). Newspaper scrapbooks provide students with opportunities to link class material with current news and scaffold students towards generating their group presentation prospectus. Final group presentations ask students to "explore a particular dimension of the wider problem of climate change past, present, and future, appropriately informed by the geophysics, biology, and/or history of climate change" (Syllabus).

Public Demonstration of competence, such as a significant public communication of their integrative analysis of the issue. Please link this expectation to the course goals, topics and activities and indicate *specific* activities/assignments through which it will be met. *(50-500 words)*

The course capstone is a group research project, requiring each student to work with their recitation group on a topic emerging from our coursework on climate change, developing and presenting a poster-display at the end of the course. Each student also writes a short 5 page paper describing their contribution to the research. The oral presentation involves each of the students, and is made to a faculty member, TA, and other students in the large poster hall. Under Covid-19 conditions in 2020 and 2021 this assignment was altered to give the students a choice between a group research-PowerPoint Zoom presentation or an individual research paper.

Experiences with diversity wherein students demonstrate intercultural competence and empathy with people and worldview frameworks that may differ from their own. Please link this expectation to the course goals, topics and activities and indicate *specific* activities/assignments through which it will be met. *(50-500 words)*

Understanding the experiences and impacts of climate change and paths to mitigation requires sensitivity to the different circumstances and positions occupied by diverse societies around the world, each shaped by their experience of global histories. This course addresses this challenge by stressing the differential origins and impacts of anthropogenic climate change. Students engage with the long histories of energy mobilization in different economies, and of the bimodal dimension of climate change, both natural climate change which has broadly shaped the human condition globally, and anthropogenetic climate change, which has been driven by the differential origins and impacts of fossil fuel economies, which have historically benefited the global north and adversely affected the global south.

Explicit and intentional efforts to promote inclusivity and a sense of belonging and safety for students, e.g. universal design principles, culturally responsive pedagogy, structured development of cultural self-awareness. Please link this expectation to the course goals, topics and activities and indicate *specific* activities/assignments through which it will be met. *(50-500 words)*

This course is designed to involve the student in a series of large and small peer -groups – the large lecture, the 20-student recitation, and the four-person recitation pod. Students are grouped in the pods to maximize the range of major, class-years, gender, and where possible, ethnicity, in an effort to ensure that each pod has a diversity of skills and perspectives. Students sit with their pods in lecture to work on questions posed at intervals by the lecturer, turning in these responses at the end of the lecture, but also working out who will speak for the pod if and when they are called upon. In section we use the jig-saw method, in which members of each pod read different materials, consult with their peers in other pods who have read the same readings, and then return to their home pod to develop a group report. Our experience is that the pods develop very cohesive and effective joint-learning environments. (Under Covid-19 we were unable to maintain the pod-structure in the in-line lectures.)

Clear plans to promote this course to a diverse student body and increase enrollment of typically underserved populations of students. Please link this expectation to the course goals, topics and activities and indicate *specific* activities/assignments through which it will be met. *(50-500 words)*

Since its origins in 2016 this class has always had high enrollment, typically filling to capacity – 150 for in-person lectures, 160 for on-line lectures. We have been very impressed by the diversity of our students. Academically they are drawn from majors across humanities, arts, social sciences, and natural science in A&S, from Engineering and the Business School. There has always been rough gender parity, and we have been impressed by the racial diversity of our students. We always attract a number of international students as well. We will continue to advertise broadly to promote this course to a diverse student body as it is a topic of broad interest and approaches the topic in an interdisciplinary approach.

GE THEME COURSES

Overview

Courses that are accepted into the General Education (GE) Themes must meet two sets of Expected Learning Outcomes (ELOs): those common for all GE Themes and one set specific to the content of the Theme. This form begins with the criteria common to all themes and has expandable sections relating to each specific theme.

A course may be accepted into more than one Theme if the ELOs for each theme are met. Courses seeing approval for multiple Themes will complete a submission document for each theme. Courses seeking approval as a 4-credit, Integrative Practices course need to complete a similar submission form for the chosen practice. It may be helpful to consult your Director of Undergraduate Studies or appropriate support staff person as you develop and submit your course.

Please enter text in the boxes to describe how your class will meet the ELOs of the Theme to which it applies. Please use language that is clear and concise and that colleagues outside of your discipline will be able to follow. You are encouraged to refer specifically to the syllabus submitted for the course, since the reviewers will also have that document Because this document will be used in the course review and approval process, you should be *as specific as possible*, listing concrete activities, specific theories, names of scholars, titles of textbooks etc.

EARTHSC/EEOB/HIST 291

Course subject & number

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)*

EARTHSC/EEEOB/Hist 1911 *2911: The Climate Crisis

*This course has been number 1911 for six years. Given the accelerating body of research on the topic of anthropogenic climate change, this course has become too difficult for a "foundation" at the 1000-level. We are submitting paperwork to change the course number to the 2000 level, as well as the title.

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In this course, students recognize and demonstrate the interdisciplinary nature of climate change by learning how scientists make measurements and build models to explore the role of humans in recent climate change and in implementing sustainable solutions, drawing upon cutting-edge research findings from peer-reviewed literature, including the most recent Intergovernmental Panel on Climate Change (IPCC) and National Climate Assessment reports.

Through readings, in-class activities during Recitations, and group projects, students explore the physical basis for climate change, impacts on biological organisms, and the ways in which humans can both adapt to and mitigate climate impacts. Because climate change is a fundamentally interdisciplinary topic that requires synthesis of knowledge from many fields, these activities constitute a higher level of analysis than a course whose goals are to introduce foundational aspects of physical science, biological science, or humanities to students. Students work with cutting-edge climate science data and advanced concepts of impacts and mitigation during in-class activities, while developing their group project, and in researching and answering essay questions on the unit exams.

Exercises and discussions draw upon cutting-edge research findings from peer-reviewed literature, including the most recent Intergovernmental Panel on Climate Change (IPCC) and National Climate Assessment reports. Students are required to critically evaluate and synthesize findings from books, articles, and the scientific literature to support their arguments.

Course subject & number EARTHSC/EEOB/HIST 291

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)

There are many ways that this course provides opportunities for the students to engage in critical and logical thinking. The focus of this course is on climate change, and students think critically about the evidence for how human activities are altering the climate and what can potentially be done to either adapt to or mitigate the effects of climate change. Students also learn the nature of scientific evidence for anthropogenic climate change, the history of past climates, and how Earth's climate is interconnected to the evolution of life on Earth and a sustainable future.

Students also evaluate the energy transition. For example, during one in-class activity students predict how society may respond to changes in future climates by a combination of solutions that include carbon sequestration and green hydrogen production. They also consider the human dimension of decision making about mitigation strategies and reduction of carbon-based economies.

Students are challenged to think critically about climate data in various forms. They evaluate and intercompare time series of paleoclimate proxy data with measurements to provide quantitative evidence distinguishing human altered climate change from natural.

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 examine temperature and carbon dioxide records over a range of time scales and understand the context of human history and deep time by exploring preserved ice core records spanning the past million years with the historical record of atmospheric temperature measurements over the past century. Students calculate the amount of carbon dioxide that could be emitted over the past century by both natural volcanic activity and by anthropogenic activity. As these rates differ by an order of magnitude, students engage in scholarly exploration of the impacts of human activity. Students make use of the Keeling curve of atmospheric carbon dioxide levels from the Mauna Loa Observatory in Hawaii to compare emissions rates (natural and anthropogenic) with the buildup of carbon dioxide in the atmosphere.

Course subject & number EARTHSC/EEOB/HIST 291

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 draw on past knowledge and unique perspectives from foundation course work in their majors. Sustainability is an interdisciplinary topic, which includes both scientific and human dimensions, and therefore bringing together students from different disciplines such as Earth Sciences, Evolutionary Biology, and History offer a unique experience for students in the course to interact.

Students find current news articles and identify concepts covered in class, and provide a synthesis of how climate approaches, data and/or methods are relevant. These short essays include properly cited references to scholarly literature. Daily news articles are readily accessible through the New York Times climate portal, and serves as a reputable source of news and information https://www.nytimes.com/section/climate

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)*

We use Top Hat to ask opinion-based questions throughout the semester, and in some cases, we track responses to similar questions towards the beginning and end of the course. For example, we ask how effective a tax on carbon is likely to be, and what social aspects of communities may portend the successes and failures of implementing climate-based policies. We also ask questions that have students use prior knowledge of Earth history (pre-human) and past human societies that have gone through energy transitions to reflect on how future human societies may reorganize.

Course subject & number EARTHSC/EEOB/HIST 291

Specific Expectations of Courses in Sustainability

GOAL 1: 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.

1.1 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)*

This course addresses the mechanism, impacts, and mitigation of climate change, one of the most pressing challenges in sustainability. Specifically, the course covers the earth system processes which govern the climate as well as how human activities (e.g., fossil fuel consumption, land use change, and sustainability) from prehistoric times to the foreseeable future have and will influence the earth's climate system. The course also covers the basic impact of climate change on biodiversity, ecosystem services, human health, global economies, and food provisioning. For example, lectures cover the predicted effect of climate change on agriculture and fisheries yields and the potential effects of those changes on economies and human health. This course also covers natural feedbacks which mitigate the influence of fossil carbon emissions on warming (i.e., confer resilience) and which amplify warming through positive feedbacks (e.g., melting permafrost). These lessons are supported by recitations which challenge students to generate simulations exploring how energy transitions (e.g., wind to coal to renewable energy) could influence the climate as well as human well-being.

1.2 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)*

As mentioned above, this course directly addresses how human activity and technological development influences humans, the natural world, and the climate drawing examples from previous icebox and hothouse epochs, prehistoric to ancient humans, as well as how future choices about the implementation of sustainable practices (e.g., renewable energy or nature climate solutions) will influence the climate and human well-being. Approaches for achieving sustainable growth and development are addressed through a discussion of how natural climate solutions (e.g., sustainable agriculture as well as reforestation and aforestation) and increased use of renewable resources. Recitations support the presentation of this material in lecture. For example, one recitation has students calculate their ecological footprint (similar to the carbon footprint) and challenges them to explore ways to reduce their ecological footprint. Another exercise has students explore the energy efficiency and carbon footprint of our food production systems by having them calculate how many calories of food they could grow on the oval if they grew corn or cows. This recitation illustrates how livestock production is relatively more energy and resource intensive than agriculture and is coupled with material that describes the carbon footprint of crops and livestock.

1.3 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)*

All students in this course must do a final project, as a group presentation or individual paper, which explores a "particular dimension of the wider problem of climate change past, present, and future, appropriately informed by the geophysics, biology, and/or history of climate change" (from Syllabus). For their projects students must develop a research question related to climate change (e.g., how it can be mitigated through sustainability, causes, or impacts) and then synthesize evidence that supports their thesis statement. All group presentations are presented to both the instructors and the students. As part of the development of these group projects (brief responses to newspaper clippings, scoping sessions with GTA's, and project proposals), students had to develop questions and a thesis statement and then use scientific articles, books, and newspaper articles to support their thesis statement. Students learn to articulate their values about sustainability through discussion and writing about (1) tradeoffs associated with mitigating versus adapting to climate change and (2) realistic consideration of the balance between our global will/ability to mitigate climate change and scientific estimates of the rate of change and its impacts on humans and the natural world. The course capstone is a group research project, all of which have involved engagement to various degrees with issues of sustainability. Some examples include:
"California Wildfires and their Effects on Society's Respiratory Health"
"Can New York City Survive Climate Change"
"Carbon in the Food Industry"
"Cattle Feeding Techniques and Methane Emissions"
"Climate Change and Avalanches"
"Climate Change and the Effects on Agriculture: Specific Focus on the United States & Tanzania"
"Climate Change and Waterborne Diseases in Africa"
"Climate Change and West Nile Virus"
"Climate Change Impacts Mosquito-Borne Disease Transmission"
"Climate Change Induced Oyster Population Decline and Related Ecological Implications in the Chesapeake Bay"
"Climate Change, Bees, and the Decline of Coffee"
"Climate Change, Pollinators, and Coffee Suitable Land"
"Climate Change's Impacts on Belize's Economy"
"Climate Effects on Boston and Miami"
"CO2 Levels' Impact on the Health of Food"

Several recitations also address this ELO including: What is required to drive the next energy transition? This recitation has students run simulations which explore the influence of slow and fast energy transitions on human society and the climate.
What is your ecological footprint? This recitation has students estimate their ecological footprint and has them explore how they can most effectively reduce their ecological footprint via changes in diet, driving, and other aspects of energy use.