CIEE Online

Course title: Climate Change  
Course number: ENVI 2001 CIEE  
Programs offering course: CIEE Summer Online  
Language of instruction: English  
U.S. Semester Credits: 3  
Contact Hours: 45  
Term: Summer 2020

Course Description
Using an interdisciplinary approach, this course investigates the causes and consequences of climate change: scientifically, socially and politically. The course draws heavily on local and global examples of climate change, from documenting climate-related changes in biodiversity to constructing sound policy on mitigation and adaptation. Through interactive learning, students draw upon their own experiences, as well as those of scientists and policy makers, and rich examples from around the world.

Learning Objectives
By completing this course, students will:

- Explain the science of how Earth’s climate system operates globally, regionally and locally
- Explore and contrast environmental, economic, social and political factors that impact anthropogenic climate change
- Investigate causes and consequences of climate change in geological time and compare them to more recent changes
- Consider data from multiple models to predict our likely climate future
- Evaluate social and cultural consequences of climate change, including who bears the brunt of negative repercussions
- Compare how policy differs nationally and discuss international attempts to mitigate and adapt to climate change
- Build their own understanding of climate change from backyard to biosphere

Course Prerequisites
None

Methods of Instruction
The course will be taught entirely online using instructor presentations, readings, case study discussions, student presentations, problem sets, discussion boards and blogs. Students will work individually and in groups to investigate and share information and opinions on important climate change topics. They will draw from their own experience, online resources, interviews, guest lecturers, a text, and materials provided by the instructor. Students are assessed using self and peer review, formative reviews by instructor of student work in progress, daily blog posts and problem sets, as well as summative assessments in the form of quizzes and a final paper.
Assessment and Final Grade

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weekly Quizzes</td>
<td>20%</td>
</tr>
<tr>
<td>Blog Entries</td>
<td>20%</td>
</tr>
<tr>
<td>Daily Problem Sets</td>
<td>20%</td>
</tr>
<tr>
<td>Climate Research Paper/Video</td>
<td>10%</td>
</tr>
<tr>
<td>Climate Policy Recommendations</td>
<td>10%</td>
</tr>
<tr>
<td>Participation</td>
<td>20%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

Course Requirements

Weekly Quizzes
There are 4 weekly summative quizzes to evaluate knowledge of concepts and required readings. Quizzes will take 15 minutes to complete and questions may be multiple choice and/or short answer formats. Each quiz is worth 5% of the final grade.

Blog Entries
Each class session (module) requires a blog entry from a student on what they learned and to answer key questions prompted by the instructor. The blog will contain moments of reflection and applications of the information, concepts and skills covered in that session. These will generally require 250-300 words per blog entry.

Daily Problem Sets
Each class session (module) includes a set of 5-10 problems for individual students to answer. Problems may require basic math, may include finding internet resources and could include well-thought or researched answers to questions posed. Each problem set will require one hour on task to complete.

Climate Research Paper/Video
Each student will construct a written manuscript OR video as a review with recommendations of a climate change topic of the student’s choosing. The topic will be approved by the instructor. A draft of the paper or video will receive comments from peers and the instructor before a final version is submitted. The final version of the paper will be 1000 words and include at least three citations or appear as a 5-minute video with at least three citations.

Time on Task: 10 hours

Climate Policy Recommendations
In the final session, students will compose a stepwise policy plan for climate change adaptation and mitigation. This plan will have a template the student completes. The final plan will draw on at least three cited sources of information. In all, this recommendation will require 750-1000 words of text.

Time on Task: 10 hours
Participation

Participation is defined as meaningful contribution in the digital classroom, using the resources and materials presented to students as part of the course. Meaningful contribution requires students to prepare in advance of each recorded session and regularly engage with the resources, discussions, reflective assignments, and all other online learning activities. Students are required to demonstrate engagement with course materials, for example, through insightful, constructive comments and by using subject-appropriate terminology in: online discussion boards, peer-to-peer feedback (after viewing the presentations of others), interaction with guest speakers, where available, and submissions related to other outside-of-class activities. Students should ensure that submitted commentary balances opinions, general impressions, and specific and thoughtful criticisms or contributions. Grades are based on the content, depth, and quality of the aforementioned types of meaningful contributions as measured per the Participation grading rubric in Canvas.

Students are also expected to use the Canvas inbox for communicating any clarifying questions they may want to ask about assessments or other course requirements.

Technology Requirements

Participation requires access to a computer with microphone (a headset and microphone are preferred over built-in sound devices) and webcam; a stable and strong internet connection; and a quiet and well-lit environment.

Attendance

Attendance Expectations: In an asynchronous online learning format, attendance takes the form of active student engagement:

- in instructional activities, course content, course tools
- with the course instructor, other students, and
- by timely completion of all assessments.

“Attendance” is more than just logging into the course on Canvas. Students must establish a record of participation in academically related activities in order to comply with this requirement.

Academically related activities include, but are not limited to:

- submitting an academic assignment;
- taking an exam or quiz;
- attending a study group that is assigned by the instructor;
- participating in an online discussion about academic matters, designed by the instructor; or
- initiating contact in Canvas with the instructor to ask a question about the academic subject studied in the course.

Academically related activities do NOT include activities where a student may be present, but not academically engaged, such as:

- logging into an online class without active participation
- contributing to or engaging in the CIEE Orientation or Community Course(s)
First Week of Class: Online courses officially commence on the first day of the term. Students must demonstrate engagement in class by no later than day 5 of the term, or risk being administratively dropped from the course with no opportunity to re-enroll. Students administratively dropped from the course for failure to engage will be considered withdrawn from the program and subject to CIEE financial withdrawal policies and fees.

Duration of Course: Continued, regular class engagement is required throughout the scheduled duration of the course, and disengagement will result in a lower participation grade for any affected CIEE course. Due to the intensive schedules for completing courses online, consistent failure to engage in the course on a weekly basis (defined as failing to engage for two or more weeks of online learning) will result in a formal written warning from the CIEE Center Director. CIEE instructors / staff will monitor student engagement on a weekly basis. The weekly schedule below outlines due dates for asynchronous learning activities for this course.

N.B. Please note the class schedule is subject to change if opportunities arise to enhance the curriculum.

Weekly Schedule

Week 1

Class 1.1  Introduction to the Climate Problem

In this session, students review the course syllabus and construction, consider and articulate their goals for the course, get to know one another, and work in groups to define basic concepts related to climate science and policy. Groups of students use and share online resources to frame major issues related to climate change. Students then work in groups to model how the Earth’s shape, tilt, spin and rotation around the sun set up global climate patterns.

Readings: Chapter 1, additional 10 pages of online readings found by the student


Time on Task: 5 hours

Due: Introduction entry, Blog entry, Discussion Board entry, Problem Set

Class 1.2  Is the Climate Changing?
Here, students address the question of whether Earth’s climate is currently changing and if/how it has changed in the past. Students interview one another, a person approximately 20 years older, and a person approximately 40 years older to assess their observations, beliefs and values about climate change. Students investigate and discuss climate denial. They analyze arguments used by climate deniers and those supporting climate change from a scientific perspective. They consider underlying forces, like economics and culture, that tend to lead people into one camp or another. Students use scientific evidence to decide if the degree and rate of current climate change lies within the normal range of climate through geological time.

Readings: Chapter 2, additional 10 total pages of text from current online sources found by students


Time on Task: 6 hours

Due: Blog entry, Discussion Board entry, Problem Set

Class 1.3 Observing Changing Climate: Lessons from the Field

Led by their instructor, students consider noticeable changes to climate observed by meteorologists and biologists. In groups, students examine different case studies where initial observation of climate change’s impacts was backed up through experimentation and data gathering, using the scientific method. Students hear from researchers examining the biological impacts of climate change in the Monteverde Cloud Forest. They use internet resources to investigate other cases from close to home and from far flung parts of the globe.

Readings: Anchukaitis, K.J. and Evans, M.N., 2010 and one other discovered by student online of 5 pages.

Watch: Climate Change and Biodiversity. 2019. Of People and Earth at https://www.youtube.com/watch?v=TrSkFXcZMD0 and two other videos discovered independently by students of total 20 minutes length.

Time on Task: 5.5 hours

Due: Blog entry, Discussion Board entry, Problem Set

Class 1.4 Explaining Climate using Simple Physics
Students begin their exploration of climate with simple physical principles underlying climate science with special focus on radiation and energy balance. Students explore the relationships between temperature and energy, electromagnetic radiation, blackbody radiation, energy balance and the conservation of energy. They work individually and in groups to practice these concepts intuitively and mathematically, also applying them to a better understanding of everyday phenomena in their world.

Readings: Chapter 3 and additional readings found by students for 10 total pages

Watch: Introduction to Atmospheric Physics. 2015. Simon Clark at https://www.youtube.com/watch?v=bKoFqXoLV0Y and two others found by students of combined 20 minutes length.

Time on Task: 5 hours

Due: Blog entry, Discussion Board entry, Problem Set

Class 1.5 Earth’s Climate System

Here, students apply the fundamental physics in the previous session to explain how greenhouse gases warm the planet and why the temperature of the Earth is rising. Students build a simple climate model based on the balance between solar energy entering Earth and then leaving back to space. They discuss the Greenhouse Effect using their energy conservation model with one, two and n-layered models, finding that the temperature of a planet is set by the number of atmospheric layers, albedo and the solar constant. Students test their theory with other planets.

Readings: Chapter 4 and one additional reading found by students of 5 pages

Watch: How Does the Climate System Work? 2012. Met Office Weather at https://www.youtube.com/watch?v=lrPS2HiYVp8 and two others found by students of combined 20 minutes length

Time on Task: 6 hours

Due: Blog entry, Discussion Board entry, Problem Set, Weekly Quiz

Week 2

Class 2.1 The Carbon Cycle and Other Major Biogeochemical Cycles Impacted by Climate

In this session, students extend their simple model to greenhouse gases and how they add layers to the atmosphere and, hence, capture and hold more solar energy. Students investigate why CO₂ is the primary greenhouse gas responsible for anthropogenic climate change. Students diagram the Earth’s carbon cycle. They begin with describing
the composition of the atmosphere and identify important greenhouse gases at play. Students then consider atmosphere – land- biosphere – ocean carbon exchange. They demonstrate how humans are perturbing the carbon cycle and increasing atmospheric carbon. Students share and answer commonly asked questions about the carbon cycle.

Readings: Chapter 5, additional online readings discovered by students of 10 total pages


Time on Task: 6 hours

Due: Introduction entry, Blog entry, Discussion Board entry, Problem Set

Class 2.2  Forcings, Feedbacks and Climate Sensitivity

Here, students extend their knowledge of climate science by adding a few additional physical principles. They extend the simple model they developed by adding time lags in energy exchange, demonstrating that what we are doing to the climate today will continue to change the climate well beyond the year 3000. This includes students defining radioactive forcing and calculating that caused by humans in the recent past. Students measure radioactive forcing contributions of greenhouse gases, manmade aerosols, volcanos, cloud cover and other sources. Students also consider human land use changes and their impact on albedo, as well as changes in the amount of solar radiation reaching the Earth, arriving at total net forcing from an array of sources. Students work in groups to identify and measure the impacts of important feedback loops in the system in light of radioactive forcing and time lags.

Readings: Chapter 6, additional readings on Climate Forcing found by students of 10 total pages

Watch: What’s Really Warming the Earth? 2016. It’s OK to Be Smart at https://www.youtube.com/watch?v=hphdsLcSTYQ

Time on Task: 6 hours

Due: Blog entry, Discussion Board entry, Problem Set

Class 2.3  Why is Climate Changing?

Students reexamine the debate over why climate is changing. They begin by tracing mechanisms that have changed climate in the past and test each of them to determine if they could be the cause of the recent warming. These include plate
tectonics, the Sun, the Earth’s orbit, natural internal variability within the Earth’s climate system and human-caused rise in greenhouse gases. Through a careful assessment of all of the possible causes, students discuss that the most likely explanation for the recent warming is the increase in greenhouse gases in our atmosphere, which is due to human activity.

Readings: Chapter 7 and Sutter, J.D. 2019. and related scientific literature on climate change drivers found online by students of 10 pages


Time on Task: 6 hours

Due: Blog entry, Discussion Board entry, Problem Set

**Class 2.4**  
**Sea Surface Temperatures, Adiabatic Cooling and a Changing Cloud Forest**

Students focus on climate change and altitude, using Costa Rica’s Monteverde Cloud Forest as an example. They begin by considering regional effects on climate, like windward/leeward precipitation on mountains, peninsular effects, island effects and others. They use internet resources to track changes to sea surface temperatures in geological time and the recent past. Students then define and apply adiabatic cooling to montane systems and its impact on local water availability. They connect rising sea surface temperatures to rising cloudbanks and how this leads to drying. Students discuss the likely impact this has on natural and human communities.


Time on Task: 5.5 hours

Due: Blog entry, Discussion Board entry, Problem Set

**Class 2.5**  
**Predictions of Future Climate Change**

Here, students discuss how predicting future climate is examining future radiative forcing. Building on earlier themes, they explore how predicting climate change is largely predicting changes in greenhouse gas and aerosol emissions from human activities. Students use such projections, known as emissions scenarios, as the
foundation of their predictions of climate change. Here, students analyze how climate models are constructed and what they tell us about our future climate.

Readings: Chapter 8 and two additional related readings by students of 10 total pages

Watch: How Climate Scientists Predict the Future. 2017. SciShow at https://www.youtube.com/watch?v=i9EyFghIt5o and two videos of total 20 minute length found online by students

Time on Task: 5.5 hours

Due: Blog entry, Discussion Board entry, Problem Set, Weekly Quiz, Final Paper Topic Ideas

Week 3

Class 3.1  Impacts of Climate Change to the Physical and Biological World

In this session, students barrel down on why they, or anyone, should care that the climate is changing. They interview people they know and watch online interviews from people around the world on their reasons to care, or not. Students then investigate different physical impacts on climate change, not only temperature, but also precipitation, sea level rise and acidification, loss of ice, as well as the degree and frequency of extreme climate events. Working in groups, students quantify these changes and link them to actual or probable future impacts on the natural world, including changes to biological systems and biodiversity.

Readings: Chapter 9 Sections 9.1-9.2, and related additional online readings discovered by students of 10 total pages


Time on Task: 5.75 hours

Due: Introduction entry, Blog entry, Discussion Board entry, Problem Set

Class 3.2  Impacts of Climate Change to the Human Community

Here, students explore and discuss climate change from a social, economic and cultural perspective. They investigate how climate change alters agriculture, suitable living space, public health and safety, political stability and economic livelihood. Students
define the Holocene and its importance to building the societies and cultures we see today. They examine case studies of societies and cultures, including those most at risk. Students discuss climate change in terms of cultural diversity, standard of living and economic class.

Readings: Chapter 9 Sections 9.3-9.5, and two additional online readings found by students for a total of 10 pages

Watch: How Climate Affects Human Health. 2019. CDC at https://www.youtube.com/watch?v=JywsWktvODc and one or two other videos found by students of 20 minutes total duration

Time on Task: 6 hours

Due: Blog entry, Discussion Board entry, Problem Set

Class 3.3 Human Population, Consumption and Technology

Students examine the ultimate drivers behind human-caused climate change, including human population and consumption. They graph trends in human population growth and compare trends to changes impacting climate over the same time, like atmospheric CO₂, land use, water use, urban development, aerosol concentrations and others. They measure their ecological footprints and compare them to those from other countries. Students look at their own place in the climate picture, by assessing their consumption patterns. Finally, students discuss how much control they have over their ecological footprints and what ultimately needs to happen to lower human impact, including the role of technology.

Readings: Chapter 10 and one additional online reading found by students of 5 pages

Watch: Rosling, H. 2013. Population Growth and Climate Change. The Guardian at https://www.youtube.com/watch?v=SxbprYjyyU and two additional related videos found by students for a total of 15 minutes

Time on Task: 5.5 hours

Due: Blog entry, Discussion Board entry, Problem Set

Class 3.4 Fundamentals of Climate Change Policy

Students define sustainability as it relates to climate and climate change. They lay out a broad framework for what we can do about climate change. Students begin by defining and comparing adaptation, mitigation and geoengineering as important factors to address in any climate change policy. They link the necessity of adaptation to lags in the Earth’s climate system response to human inputs. Students explore the importance of
mitigating negative impacts of current and future climate change, as well. To do this, they calculate the scale of reductions necessary to make an impact, in light of energy efficiency and carbon intensity. Finally, groups of students use online resources to explore technologies that will help adapt and mitigate.


Watch: The Paris Accord – What Does It All Mean? 2017. VlogBrothers at https://www.youtube.com/watch?v=Sr2J_1J9w3A

Time on Task: 6 hours

Due: Blog entry, Discussion Board entry, Problem Set, Final Paper Outline

Class 3.5  
**Attitudes toward Climate Change Policy between the U.S., Costa Rica and Globally**

Here, students compare how different places in the world react to climate change through policy. They contrast three models: the U.S., Costa Rica and a country or region of their choosing. In doing so, they consider population, national wealth and culture as elements in climate change policy. Students also consider ways these countries have adapted to climate change, plans for future adaptation, and mitigation. They compare their energy use and source of energy and commitment to sustainability. Students develop and construct an assessment tool or score card to measure relative commitments for adaptation and mitigation to climate change.


Watch: Introduction to Climate Change Policy. 2014. Climate Literacy at https://www.youtube.com/watch?v=O2SHFPn7Giw

Time on Task: 6 hours

Due: Blog entry, Discussion Board entry, Problem Set, Weekly Quiz

Week 4

Class 4.1  
**Mitigation Policies**

In this session, students discuss the need for more mitigation and how to effect mitigation through policy. They examine the role of the individual, community and governments in defining and enacting mitigation measures. Students identify and discuss benefits and limitations of conventional regulations, like emissions standards. They compare these to market-based regulations, such as carbon taxes. Students also
define cap and trade mitigation and applications of cap and trade systems around the world. They debate the relative merits of cap and trade vs. carbon taxes. Students explore carbon offset programs and learn how they have been used in Costa Rica, as well as other places in the world. Finally, students define and consider information and voluntary methods of climate change mitigation.

Readings: Chapter 12 and NASA. 2020

Watch: Bows-Larkin, Al. 2015 Climate Change is Happening. Here’s How We Adapt. TED at https://www.youtube.com/watch?v=fw01_q0cxM8 and Climate Change 2014 – Mitigation of Climate Change. 2014. Intergovernmental Panel on Climate Change (IPCC) at https://www.youtube.com/watch?v=gDcGz1iVm6U

Time on Task: 6 hours

Due: Introduction entry, Blog entry, Discussion Board entry, Problem Set

Class 4.2 Climate Science and Policy Until Now

Here, students trace the history of climate science and its impact on climate policy. This involves a timeline approach to changes in U.S. thinking, attitudes and policies related to the environment and climate change. Students extend this timeline beyond the Obama years into the U.S.‘s current climate policies. They compare U.S. policies to China and Europe over the same time period and discuss how policies agree and differ. Students discuss the increasingly global nature of climate adaptation and mitigation.

Readings: Chapter 13, BBC. 2013 and Childress, S. 2012

Watch: Hsu, A. 2018. How China Is (and Isn’t) Fighting Pollution and Climate Change. TED at https://www.youtube.com/watch?v=VIHiEN1zTKI

Time on Task: 6 hours

Due: Blog entry, Discussion Board entry, Problem Set, Final Paper Draft

Class 4.3 What is Needed to Make Climate Policy Effective and Workable?

Led by their instructor, students compare case studies, role play and use popular media to construct a list of factors they feel are needed to make climate policy workable and effective. Along the way, they consider the importance of government structure (democracy, monarchy, dictatorships, etc.), education, the news media, transparency, the role of NGOs, scientists, and other shareholders in forging the will to invest in research and technology, the political will to devise and enforce climate policy, as well as the relative importance of short and long-term economic gains.
Readings: Barrett, S. et al 2015 and one chapter of choice from de Melo, J. et al. 2015

Watch: 8 Things You Can Do About Climate Change Right Now. 2020. BuzzFeed Video at https://www.youtube.com/watch?v=9Gz7CYbyEp8

Time on Task: 5.25 hours

Due: Blog entry, Discussion Board entry, Problem Set

Class 4.4  Social Psychology, Culture and Climate Policy

Students begin by defining the Tragedy of the Commons and its place in their understanding of climate policy. They explore social psychology and what it adds to their understanding of climate change attitudes. Students also use principles of social psychology to analyze and predict how societies and cultures have and are likely to change with changing climate.


Watch: Climate Change is Making this Country Disappear. 2020. CNN at https://www.youtube.com/watch?v=_neGOQ8oLCo and Fleeing Climate Change – The Real Environmental Disaster. 2019. DW Documentary at https://www.youtube.com/watch?v=cl4Uv9_7KJE

Time on Task: 6 hours

Due: Blog entry, Discussion Board entry, Problem Set

Class 4.5  Putting it All Together: Next Steps in Climate Change Science and Policy

Here, students critique the elements of plan for an effective response to climate change. They analyze the step-by-step logic that underlies the most commonly suggested policies for addressing climate change. They discuss how our choice of climate and energy policy must reflect the science as well as the economic trade-offs and moral judgments about the alternatives. Finally, students present their own best plan for an effective policy response to climate change.

Readings: Chapter 14 and Nordhaus, W., 2019


Time on Task: 6 hours

Due: Blog entry, Discussion Board entry, Problem Set, Final Paper
**Course Materials**

**Textbook**


**Readings**


