

**CAS BI 306 – Biology of Global Change  
Course Syllabus - Fall 2021**

**Instructor:** Dr. Colleen Bove (she/her)

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**Lectures:** Tuesdays and Thursdays 11am-12:15pm, **SCI 113**

**Office Hours:** Tuesday/Thursday 3:30-4:30 PM and by appointment (BRB 217)

**Website:**

**TF:**

**Lab Sections:**

**Email:**

**TF:**

**Lab Sections:**

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**Lab Section:**

**Email:**

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BI 306 lecture and lab will be fully in person Fall 2021 following BU's most recent policies, however, this is subject to change at any time. Any changes to course meeting locations and times will be communicated in advance to all instructors and students.

**COVID Safety Policies:**

Masks must be worn by instructors and students at all times according to BU policy (<https://www.bu.edu/back2bu/>) and the CDC's recommendation, regardless of vaccination status. Students and instructors must also adhere to BU's COVID testing policies and maintain good standing with daily symptom monitoring by displaying a cleared badge before entering the room. Anyone not wearing a mask or noncompliant with BU's monitoring will be asked to leave. If you refuse, the class will be dismissed in order to protect everyone. We also require that you follow the safety practices recommended by the CDC outside the classroom, including all state and university guidelines regarding sheltering in place while feeling ill, testing, quarantining, social contacts, and gatherings. Do not put your classmates in danger. Do not put staff and instructors in danger.

**Every student must fill out this compliance survey before attending EACH lecture:**

<https://forms.gle/8esMASJZhZkq31GG9>

**Attendance Policies:**

You are expected to attend all lectures. If you must miss a lab for any reason, you need to communicate this with your TF or lecturer BEFORE the start of your scheduled lab time. Failure to communicate a missed lab in advance without a valid excuse will result in a 20% point deduction in the lab assignment submitted the following week.

### **Diversity Statement:**

In this class, we are seriously committed to supporting diversity and inclusion among all classroom community members. We proactively strive to construct a safe and inclusive environment by respecting each other's dignity and privacy. We treat one another fairly and honour each member's experiences, beliefs, perspectives, abilities, and backgrounds. Our collective group is stronger because we strive to bring together people of all races, religion, language, immigration status, sexual orientation, gender identification, ability status, socio-economic status, and national identity. Bullying, hateful ideas, violent language, belittling, racial slurs, and other disrespectful or "othering" language or behaviour will not be tolerated in the classroom or online. Our class provides a safe space for free inquiry and open exchange of ideas. Therefore, though we might feel strongly about a topic, we maintain respect for each other's diversity. We act and communicate respectfully toward one another, both directly and indirectly, both inside and outside the classroom. All members contribute to building a caring, inclusive learning environment that promotes productive participation and sharing, and engenders growth among us all. As a classroom community, we share these values. **If you ever have any concerns about the lab or lecture climate, please reach out to an instructor (TF or lecturer).**

### **Land Acknowledgment Statement:**

We acknowledge that the territory on which Boston University stands is that of The Wampanoag and The Massachusetts People. Our classroom and BU's campus are places to honour and respect the history and continued efforts of the Native and Indigenous community leaders which make up Eastern Massachusetts and the surrounding region. This statement is one small step in acknowledging the history that brought us to reside on the land, and to help us seek understanding of our place within that history. Ownership of land is itself a colonial concept; many tribes had seasonal relationships with the land we currently inhabit. Today, Boston is still home to indigenous peoples, including the Mashpee Wampanoag and Wampanoag Tribe of Gay Head (Aquinnah).

### **Learning Objectives:**

The following list provides the knowledge and skills students are expected to achieve through the completion of this course:

1. Describe, analyze, and assess the ecological impacts of human activities on terrestrial and aquatic ecosystems, including climate change, forest decline, eutrophication, acidification, loss of species diversity, emergent diseases that are related to environmental change, and restoration of ecosystems.
2. Apply concepts learned in the classroom and laboratory to formulate testable hypotheses, conduct measurements, and analyze real-world data.
3. Gather, assess, and utilize information from peer reviewed governmental and internet sources of knowledge to better understand your results, place them in the context of current scientific understanding, and to test hypotheses.
4. Identify, describe, analyze, and make judgements about the ethical questions related to pressing global environmental issues including climate change and engage in civil discussion about it with those who hold views different from your own.

**Required Reading:**

- *Science: Toward a Sustainable Future*, 13<sup>th</sup> Edition. 2017. Richard T. Wright and Dorothy F. Boorse. Pearson. Digital version available through Barnes & Noble to rent or to purchase.
- Supplemental reading from the primary literature, available on course website

**Important Dates:**

Last day to add a class is 16 September 2021

Last day to drop without a 'W' grade is 7 October 2021

Last day to drop with a 'W' grade is 5 November 2021

**Course Component Breakdown**

Course and Exams	50%	200 points
Laboratory Grade	50%	200 points
<b>TOTAL</b>	<b>100%</b>	<b>400 points</b>

**Lecture Grades Breakdown**

Item	Points	Lecture Percentage	% of Total Grade in Course
Exam 1	30	15%	7.5%
Exam 2	50	25%	12.5%
Exam 3 (Final)	60	30%	15%
Quizzes (10 total)	40	20%	10%
Guest Lectures	20	10%	5%
<b>TOTAL</b>	<b>200</b>	<b>100%</b>	<b>50%</b>

## BI 306 – Biology of Global Change Lecture Schedule

Date	Topic	Readings
<b>I. Climate Change and Environmental Constraints</b>		
2-Sep	Introduction to Ecology and Global Change Biology; Drivers of Ecosystem Structure & Function	Chapter 1; Chapter 5 (pp. 99-107); Trisos et al. 2021
7-Sep	Earth's Climate	Chapter 10 (pp. 233-251); Chapter 18 (pp. 435-441)
9-Sep	Climate and Biomes	Chapter 5 (pp. 107-113)
14-Sep	Greenhouse Gases and Global Climate Change	Chapter 18 (pp. 441-463)
16-Sep	Climate Change in the Northeastern USA	Review Chapter 18
21-Sep	Kyle Oliveira (Shifting White Shark Habitat); Ecosystem Ecology: Productivity	Chapter 3; <b>TBD</b>
<b>II. Global Change: Land-Water-Atmosphere Interactions</b>		
23-Sep	<b>Exam # 1</b> ; Fire Ecology	Westerling et al. 2006; Keane et al. 2008 * <i>These readings do not need to be completed before lecture because of the exam but should be reviewed</i>
28-Sep	Air Pollution	Chapter 19 (pp. 465-490)
30-Sep	Dr. Josh Drew (Mapping and Historical Ecology; <b>In person</b> )	McClenachan et al 2015; Ted-Ed talk ( <a href="https://www.youtube.com/watch?v=B-vYGcl_nA8">https://www.youtube.com/watch?v=B-vYGcl_nA8</a> )
5-Oct	Aliyah Griffith (Barbados Coral Reefs); Air Pollution	Chapter 19 (pp. 465-490); <b>TBD</b>
7-Oct	Air Pollution: Human Alteration of the Global Nitrogen Cycle	Canfield et al. 2010; Battye et al. 2017
12-Oct	<i>No Lecture - Monday Schedule</i>	
14-Oct	Urban Ecology	Chapter 23, Seto et al. 2012
19-Oct	Air Pollution: Human Alteration of the Mercury Cycle	Krabbenhoft & Sunderland 2013
26-Oct	Ozone in the Troposphere & Stratosphere	Chapter 19 (pp. 490-497); Solomon 2004; Shanklin 2010
28-Oct	Fertilizers and Pesticides: Agriculture	Chapters 12 and 13; Childers et al. 2011
2-Nov	<b>Exam #2</b>	
4-Nov	Dr. Kaylyn Gootman (Land Use Impacts on Water Quality; <b>Zoom</b> )	Petersen and Hubbard 2020; Kellner et al. 2018; Coulter, Kolka, and Thompson 2004
<b>III. Global Change: Biodiversity, Land-use Change and Conservation</b>		
9-Nov	Land Use Change and Habitat Fragmentation	Foley et al. 2005, Marris 2009

11-Nov	Max Dipple (primates and anthropomorphic impacts) and Steve Gougherty (plant reproductive allocation and climate change); <b>In person</b>	<b>TBD</b>
16-Nov	Loss of Species	Ellison et al. 2005
18-Nov	Species Introductions and Ecosystem Feedbacks	Chapter 4 (pp. 94-96); Strayer 2009
23-Nov	<i>No Lecture - Holiday</i>	
25-Nov	Species Introductions and Ecosystem Feedbacks ( <i>cont.</i> )	
30-Nov	Restoration Ecology	Craig et al. 2008; Duarte et al. 2009; Chapter 5 (pp. 120-124)
7-Dec	Emerging Diseases and Links to Ecology	Chapter 17; Keesing et al. 2010; Johnson et al. 2010
9-Dec	Climate Change and Human Health	
15-Dec	<b>Exam #3 (Final Exam) - 12:30 - 2:30 PM</b>	

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**\*\* This syllabus is subject to change, as circumstances require. Any changes will be communicated via Blackboard announcements and email by instructors.**

## Course Notes

### Boston University General Education Hub Areas

This course fulfills a single unit in each of the following BU Hub areas: *Scientific Inquiry II*, *Ethical Reasoning*, *Research and Information Literacy*.

*Scientific Inquiry II*: Students will learn how to describe, analyze, and assess the ecological impacts of human activities on terrestrial and aquatic ecosystems. By conducting hands-on exercises in the field and laboratory, students will learn how to apply concepts learned in the classroom to formulate testable hypotheses, conduct measurements, and analyze real-world data. These lessons will enable students to understand and answer questions related to the natural environment and how human activities are changing it.

*Ethical Reasoning*: Students will learn how to identify, describe, analyze, and make judgements about the ethical questions related to pressing global environmental issues including climate change and engage in civil discussion about it with those who hold views different from their own.

*Research and Information Literacy*: Students will learn how to gather, assess, and utilize information from peer reviewed, governmental, and internet sources of knowledge to better understand their results, place them in the context of our current scientific understanding, and to test hypotheses.

### Lectures

Lectures are the core of the course. They are designed to introduce the important concepts in the field of Global Change Biology and help clarify information and ethical issues presented in the textbook, supplementary readings, and laboratory exercises. Within the Lecture periods, students will share recent scientific articles from the popular press or primary literature with the rest of the class. Classroom discussions will include a description, analysis, and evaluation of articles that will help students better understand real-world applications of classroom lessons and to gain first-hand ethical reasoning skills. Through these exercises, students will learn the vocabulary of global biology and understand the unique types of experimentation involved. In the discussion of these articles in science and popular media, students will wrestle with real-world issues that affect future generations and responsible stewardship of the planet. **A large fraction of the information presented is only available in lectures. Failure to attend regular and guest lectures will seriously compromise opportunities for gaining the full benefits of this course and will likely affect how well you perform on exams.**

### Laboratory

The laboratory is considered an integral part of the course and is thus required. It accounts for 50% of your grade for the course. Laboratory sessions consist of a mixture of field trips, lab exercises, and discussions. You may not change to another section without approval from your TF; it is important to keep the number of students in each section approximately equal. Attendance will be taken every week. Labs are meant to be fun rather than a chore, so come with an open mind and a willingness to work hard, to ask questions and offer an opinion! Guidelines for each assignment will be discussed in the lab section. Please contact your Teaching Fellow for questions regarding a lab assignment. **Due dates are absolute! 10% of points per day will be deducted for late assignments, and after one week the assignments will not be accepted.** See the lab syllabus for full details on lab policies and calendar.

### Text and Supplemental Readings/Exercises

The text, *Environmental Science: Toward a Sustainable Future*, 13<sup>th</sup> Edition by Richard T. Wright and Dorothy F. Boorse, is meant to reinforce material presented in lecture. Each lecture has an associated reading assignment in a particular chapter. Some of the latest news from the frontiers of ecological science

will also be presented. This material is not covered in your text. This makes it absolutely critical that you attend lecture. There will also be a series of supplemental readings that will form the basis of occasional discussions. Questions from these supplemental readings will be included on each exam. Make sure you read the articles and participate in the discussions to get the most out of these readings.

## **Exams**

There will be three exams throughout this course. The first two exams will take place during regular lecture times while the third will be given during the allotted Final Exam time slot. When studying for exams, you should rely equally on lecture material, relevant sections in your textbook and the supplemental readings. Questions on exams will be drawn from these sources. In other words, you should do the assigned readings and attend lectures if you expect to do well in the course. **Exams will be given during a regularly scheduled lecture time. No make-up exams will be given without documentation that the absence was unavoidable. In such cases, make-up examinations will be scheduled on a case-by-case basis.**

## **Academic Conduct**

Below is a reprint of the Boston University Academic Conduct Code as it appears on the following web-site: <https://www.bu.edu/academics/policies/academic-conduct-code/>

Departures from this code can have serious repercussions.

“All students entering Boston University are expected to maintain high standards of academic honesty and integrity. It is the responsibility of every undergraduate student to be aware of the Academic Conduct Code’s contents and to abide by its provisions. The Academic Conduct Committee of the individual school or college, which is composed of students, faculty and staff, has jurisdiction over all charges of academic misconduct brought against students.

In all charges of academic misconduct against a student, the student is entitled to full procedural fairness in any disciplinary proceedings. The Academic Conduct Code details the guidelines governing disciplinary proceedings. It also articulates the University’s philosophy of discipline, defines violations of the code, and enumerates penalties applicable under the code.”

**All work that you submit must be written in your own words and have the appropriate citation.**

## **Feedback**

I welcome your feedback about how the class is going. Please tell me if you have issues or complaints so I can make adjustments before the semester is over. Your input will make the class better for yourself and for other students, as well as for the instructors

## **BI 306 – Laboratory Topics and Learning Objectives**

*First week of Lab: 6-10 September*

### **Literature Scavenger Hunt**

Students will learn how to use evidence from the scientific literature to support claims. In this laboratory, students will learn how to search scientific literature websites for peer reviewed literature, a critical skill for navigating the enormous amount of scientific information available. Students will complete a scavenger hunt by using Web of Science to find ten peer reviewed scientific journal papers that match specific criteria provided, such as a specific author, a specific journal, a specific topic within a range of publication years, etc., Students will report their findings with a complete publication citation using a defined format.

### **Winter Climate Change**

The Earth's climate is dynamic and fluctuates due to natural phenomena, including volcanic eruptions, changes in the Earth's orbit and the amount of energy released from the Sun. Since the Industrial Revolution, humans have emitted a significant amount of trace gases to the atmosphere that have led to the enhanced greenhouse effect, which is influencing the form and amount of precipitation, as well as temperature, of our planet. The objectives of this exercise are to familiarize you with Microsoft Excel and basic statistical analyses, to provide feedback on your scientific writing in preparation for the lab write-ups and reports required in this class. In this lab, students will analyze existing winter climate data from an ongoing climate change experiment at Hubbard Brook Experimental Forest in the White Mountains of New Hampshire. Students will analyze and graph data, interpret results

### **Water Quality**

Water quality is a term used to describe the chemical, physical, and biological characteristics of water. The objectives of this lab are to assess and compare water quality among waterways in and around Boston and to use these measurements to assess the water quality of these aquatic ecosystems. Students will sample water from the Charles River and complete laboratory analyses of water chemistry. Students will analyze and graph the data and place their results in the context of the broader peer reviewed literature.

### **Ecosystem Productivity and Carbon Storage**

There is increasing attention being focused on the ability of ecosystems to store or lose carbon. Any carbon that is stored in an ecosystem means that it is not lost to the atmosphere where it can contribute to the enhanced greenhouse effect. In this lab, you will learn how to construct a carbon budget for an ecosystem. Students will travel to a hardwood and conifer forest to measure the size of trees using DBH tape and use tree species specific allometric equations in the laboratory to convert tree size to total aboveground standing stocks of carbon. Students will sample soils from both forest types and analyze them in the laboratory to determine total belowground standing stocks of carbon. Students will analyze their data to investigate the role of tree species composition in carbon budgets of Northeastern U.S. forest ecosystems. Students will place their results into the context of past findings published in the scientific literature. They will write a laboratory report that includes graphs and tables, as well as a Discussion explaining how their results are similar or different from those of published journal article findings.

### **Species Alterations with Climate Change**

Many changes in species' distributions and abundances have been attributed to human alteration of atmospheric CO<sub>2</sub> levels and the resulting increase in global temperatures. The extent to which particular species are involved, the magnitude of shifts in distribution and abundance and the timeline for these shifts is a matter of great scientific debate. The objectives of this week's lab exercise are to prepare and organize presentations focused on alteration in species' abundances and distributions due to global climate change. Students will use the scientific literature to assess how global change has influenced the spatial distribution and abundance of a taxon (or taxa) and then will facilitate a laboratory discussion about their findings.