

## **ENVST 385: Climate and Life**

*Instructor:* Sonali Shukla McDermid, Associate Professor

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4 points.

*Prerequisite:* ENVST-UA 100, Environmental Systems Science

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### **Syllabus**

#### ***Instructor:***

Sonali McDermid is a climate scientist and Associate Professor in the Dept. of Environmental Studies here at NYU. A description of her research is available at: [www.sonalmcdermid.com](http://www.sonalmcdermid.com)

*Office hours:* Mondays 5-7pm, 285 Mercer Street, 7th Floor, Office 703

To ensure availability (and avoid long waits), please make an appointment [Here](#) or please email me if these days/times do not work for you.

#### ***Components of Course Description:***

In this era of global environmental change, among our chief concerns are the impacts to life on Earth - Earth's Biosphere - including natural and human systems (and couplings thereof). We hear much about the negative effects of climate and environmental changes on the Biosphere, from species extinction to human "forced migration", and for good reason. Nevertheless, there are myriad responses of the Biosphere to change, anthropogenic and natural, that are also adaptive and transformative. Indeed, the Biosphere itself exerts a major influence on the physical environment and climate systems, and has over geologic and historical time shaped these systems as we know them today. The Biosphere will *feedback on* and shape the climate and environments of the Anthropocene, both now and in the future.

This course is designed to help students understand and explore the role of the Biosphere in Earth's systems and processes, with particular emphasis on the climate system. We will begin by understanding the evolution and structure of life on Earth as it relates to our climate's evolution, and key principles of Biosphere-climate interactions. Students will gain an appreciation for the Biosphere as not just a passive recipient of environmental and climate change, but its active mediator, and in some instances, a driver of these changes. We will then use this new knowledge and appreciation to explore the response of the Biosphere to change, anthropogenic and natural, and track, understand, and anticipate current and future changes in natural and human Biospheric systems. We will end with considering what these Biosphere-climate interactions mean and imply for future thinking and policy on biodiversity conservation, climate change mitigation, human migration, extinction, and other key issues (some of which are the focus of other Environmental Studies Dept. courses). This course assumes the student has acquired foundational principles and skills from ENVST 100 Environmental Systems Science (or similar), and will use this knowledge as a starting point to dive deeper and tackle the following broad course objectives:

- Understand key Biosphere-climate interactions and feedbacks, how they shape each other, and their evolving relationship from Earth’s beginning to the future
- Understand Anthropocene influences on these Biosphere-climate interactions, inclusive of future attempts to leverage these interactions in order to address global climate and environmental change

***Assignments, Assessments, and Grading Policies:***

<b>Component</b>	<b>Description</b>	<b>Value (% of final grade)</b>
Assignments	<p>Administered approximately weekly and will be due the following week on Friday (one week from issue). Will comprise five (5) questions, for a maximum of 5 pages in response length, representing a combination of conceptual and quantitative analysis questions. One assignment will require a visit to AMNH or similar learning experience.</p> <p>Late assignments will not be accepted. If you need an extension, please email me to discuss the terms on a case-by-case basis</p> <p>Assignments should be have the filename “<b>YourName_HW#_ENVST385</b>” (e.g. “McDermid_HW1_ENVST385.docx”). Homeworks without this filename convention will lose 5% of maximum point value.</p> <p><i>Please use template provided on page 10</i></p>	45
Midterm Exam	<p>The midterm will be the week of 3/7/2022</p> <p>It will comprise five (5) short answer questions, some questions with multiple parts. Will be a mix of quantitative and conceptual questions. Will be administered in class, over a full 1 hour and 15 min period. A study guide and review will be provided.</p> <p>Missing an exam without a valid excuse or pre-arranged accommodation will result in an automatic grade of “0”. Please see me to discuss any needed accommodations on a case-by-case basis</p>	20

Final Project	<p>You will be required to turn in a final project at the end of the term. This final project will be in the style of a science proposal (e.g. similar to what scientists submit to the National Science Foundation).</p> <p>Projects should be ~12 pages minimum to 15 pages maximum, 1.5 spacing, 12 point common font (e.g. Times New Roman)</p> <p><i>Please use template provided on page 11</i></p> <p>Several assignment questions during the semester will be structured to help you make progress on your project. You will also be required to meet with the course Instructor to discuss your project mid-way through the semester.</p>	30
Participation	<p>Attendance is mandatory and if you expect to be late to class, please do let me know if advance. Regular tardiness without notification will result in a loss of points for the course.</p> <p>Students will be expected to engage constructively and reference readings during in-class discussions on a regular basis.</p>	5
Pop quizzes	<p>These will be issued at random 4 times during the semester. They will consist of 3 multiple choice questions, 1 point each, for a maximum of 12 points for the semester. You will have 7 minutes to answer each quiz.</p> <p>Note: these will not count against you. Your % score on these quizzes (your total points divided by 12) will be used to calculate and add “extra credit” to your final grade, with a maximum of 4%.</p>	Maximum value of 4% of your final grade

***Text and Readings:***

Weekly readings will vary between 40-70 pages per week in total (split between the required text and supplemental readings). While lower than a typical class, these readings will be dense as they cover complex, systems-oriented topics and will include some graduate-level texts and

scientific publications. We will discuss in the first week how to approach these more complex readings effectively and efficiently to support your learning.

*Required Text:*

Erica Bree Rosenblum, *Global Change Biology: the study of life on a rapidly changing planet* (Oxford University Press).

You are able to purchase this as a physical or electronic book at:

<https://global.oup.com/academic/product/global-change-biology-9780190644642?cc=us&lang=en&>

*Supplemental Readings:*

This course will also be supplemented by readings external to the main text, **which will be provided to you free of charge** either directly as a PDF or via NYU Libraries. See the course schedule below for details.

Some of these supplemental readings will come from the following text:

Ecological Climatology

Gorden Bonan

Cambridge University Press

<https://www.cambridge.org/core/books/ecological-climatology/D146443B007985BC366B2512345692C0>

***Student Expectations on Academic Integrity:***

Academic integrity means that the work you submit is original. Obviously, bringing answers into an examination or copying all or part of a paper straight from a book, the Internet, or a fellow student is a violation of this principle. But there are other forms of cheating or plagiarizing which are just as serious — for example, presenting an oral report drawn without attribution from other sources (oral or written); writing a sentence or paragraph which, despite being in different words, expresses someone else's idea(s) without a reference to the source of the idea(s); or submitting essentially the same paper in two different courses (unless both instructors have given their permission in advance). Receiving or giving help on a take-home paper, examination, or quiz is also cheating, unless expressly permitted by the instructor (as in collaborative projects). Violations of these principles on any graded item in the class will result in a failing grade for that item; repeated violations will result in both a failing class grade and referral to a Dean.

For more information about NYU's Academic Integrity policies, see here:

<https://cas.nyu.edu/content/nyu-as/cas/academic-integrity.html>

***Disability Disclosure Statement:***

Academic accommodations are available for students with disabilities. The Moses Center website is [www.nyu.edu/csd](http://www.nyu.edu/csd). Please contact the Moses Center for Student Accessibility (212-998-4980 or [mosescsd@nyu.edu](mailto:mosescsd@nyu.edu)) for further information. Students who are requesting academic accommodations are advised to reach out to the Moses Center as early as possible in the semester for assistance.

NYU's Henry and Lucy Moses Center for Students with Disabilities

726 Broadway, 2nd Floor

New York, NY 10003-6675

Telephone: 212-998- 4980

Voice/TTY Fax: 212-995- 4114

Web site: <http://www.nyu.edu/csd>

*Course Schedule:*

***Week 1 - Introduction***

- An overview of topics, syllabus, course expectations
- An introductory exercise on systems thinking: biosphere-atmosphere-hydrosphere interactions
- Scales of analysis; orders of magnitude; and approaches to global change biology (Rosenblum Chapter 1)
- Components of the Earth system (Bonan Chapter 2)

*Readings and Outside Class:*

- *SERC Primer on Systems Thinking:*  
[https://docs.google.com/document/d/10iObxTS7TA\\_ZBXhTb0HBDgHi39aojuoO/edit](https://docs.google.com/document/d/10iObxTS7TA_ZBXhTb0HBDgHi39aojuoO/edit)
- A introduction/review of Systems Thinking:  
<https://thesystemsthinker.com/introduction-to-systems-thinking/>
- *Rosenblum, Chapter 1*
- *Bonan, Chapter 2*

***Week 2 – Biosphere-Climate Interactions:***

- Brief review of Earth's climate system, and its geological, historical, and anthropogenic evolution
- Ecosystems and Climate: how life has shaped Earth's climate evolution
- Pre-historical to current biogeography

*Readings and Outside Class:*

- *Rosenblum, Chapter 2: 33-38; 42-45; 49-51*
- *Rosenblum, Chapter 5: 109-110*
- *Bonan, Chapter 1*
- *Bonan, Chapter 6*

***Week 3 – Biosphere-Climate Interactions (con't):***

- The role of the biosphere in Earth's cycles: physical and chemical
- Climate variability and Earth's biosphere

*Readings and Outside Class:*

- *Rosenblum, Chapter 9: 267-268*
- *Bonan, Chapter 3*
- *Bonan, Chapter 7*

**Week 4 – Land-Climate Interactions:**

- Soils
- Biospheric controls on the hydrosphere
- Biometeorology
- Exercise in Land-atmosphere-climate interactions across space and time

*Readings and Outside Class:*

- *Bonan, Chapter 21*
- *Seneviratne et al (2010) Investigating soil moisture-climate interactions in a changing climate: A review. Earth Science Reviews: <http://dx.doi.org/10.1016/j.earscirev.2010.02.004>*

**Week 5 – Terrestrial Ecology:**

- Terrestrial biological strategies
- Populations and Communities
- Ecosystems

*Readings and Outside Class:*

- *Bonan, Chapter 18*
- *Bonan, Chapter 19*
- *Bonan, Chapter 20*

**Week 6 – Aquascapes and oceans:**

- Aquatic biological interactions with regional and global climate
- Key oceanic carbon pumps and regulation of the climate system
- *Guest lecture on the importance of aquatic biology in regulating the climate system/mangroves*

*Readings and Outside Class:*

- *Honjo, S., et al (2014) Understanding the role of the biological pump in the global carbon cycle: An imperative for ocean science. Oceanography: <http://dx.doi.org/10.5670/oceanog.2014.78>.*
- *Donato et al (2011) Mangroves among the most carbon-rich forests in the tropics. Nature Geoscience: <https://doi.org/10.1038/ngeo1123>*

**Week 7 - Humans**

- Pre-historic hominids and climate change
- The Anthropocene
- Anthropogenic climate change

*Readings and Outside Class:*

- *Rosenblum, Chapter 3*
- *Rosenblum, Chapter 4*
- *Rosenblum, Chapter 8: 212-225*
- *Bonan, Chapter 8*

***Week 8 – In-class review and synthesis activity; Midterm Exam***

***Week 9 – Biospheric Adaptation and Climate:***

- Brief review of biological strategies (phenology; life history; disturbance; etc.)
- Biological strategies in a climate perspective
- Guest Lecture on urban environments, climate adaptation, biodiversity

*Readings and Outside Class:*

- *Rosenblum, Chapter 6*
- *Rosenblum, Chapter 7: 173-180; 193-195*
- *Bonan, Chapter 18*

***Week 10 – Biospheric Adaptation and Climate (con't)***

- Biological vulnerability to climate change, limitations, and feedbacks
- Potential shifts to biogeography

*Readings and Outside Class:*

- *IPCC AR5, WG2, Chapter 4: 290-326, FAQ boxes*
- *IPCC AR5, WG2, Chapter 6: 424-456, FAQ boxes*

***Week 11 – Biological Mobility and Climate Change:***

- Plant and non-human animal mobility
- “Invasive” species
- Human mobility in an era of climate change

*Readings and Outside Class:*

- *Rosenblum, Chapter 5*
- *IPCC AR5, WG2, Chapter 12: Executive Summary; 766-771*
- *IOM Report on Migration and Climate Change: Executive Summary; 11-29*
- *Pecl et al. (2017) Biodiversity redistribution under climate change: Impacts on ecosystems and human well-being. Science: 10.1126/science.aai9214*
- *Hill and Hadley (2018) Rethinking “native” in the Anthropocene. Front. Earth Sci: 10.3389/feart.2018.00096*

***Week 12 – Community and Ecosystem Responses to Change:***

- Community-level responses to global environmental change
- Ecosystem-level responses to global environmental change
- Exercise on key biosphere interactions and feedbacks to the climate system

*Readings and Outside Class:*

- *Rosenblum, Chapter 9: 241-251, 259-260*
- *Rosenblum, Chapter 10*
- *Lovejoy and Nobre (2018) Amazon Tipping Points. Science Advances 4 (2), eaat2340. DOI: 10.1126/sciadv.aat2340*

***Week 13 – The Biosphere in the Anthropocene***

- The intersection of climate action and biodiversity conservation
- Leveraging biospheric dynamics and interactions for climate mitigation?
- *Guest Lecture on biodiversity conservation and the role of humans*

*Readings and Outside Class:*

- *Rosenblum, Chapter 11*
- *Rosenblum, Chapter 12*

***Week 14 – Implications coupled natural-human systems; Wrap-up Discussion***

- Close out any outstanding topics/questions
- Links with other dept courses
- Presentation of final projects

*Assignment Template*

**ENVST 385: Climate and Life**

Assignment 1

100 points

Spring 2022

Due Date: TB

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***Your Name Here***

*Please provide short answers no more than a page to each of the following questions. Feel free to use supplemental resources and discuss with peers, but please make sure to complete the assignment alone and in your own words, and to cite all your work when appropriate (i.e. add a "References" section). Only use primary resources (no "Wikipedia"). I accept any major form of citation/referencing.*

*Question 1.*

Your answer

*Question 2.*

Your answer

*Question 3.*

Your answer

*Question 4.*

Your answer

*Question 5.*

Your answer

*Works cited:*

*Final Project Template*  
**ENVST 385: Climate and Life**  
**Final Proposal Project**  
**100 points**

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*Principal Investigator:*  
YOUR NAME HERE

*Co-Investigators:*  
<LIST COLLABORATORS>

*Project Summary/Abstract (1.5 pages total maximum)::*

This should consist of the following:

- (a) Summarized problem statement (10 pts)
- (b) Approach (10 pts)
- (c) Intellectual Merit: how will this project contribute to the field of knowledge? (10 pts)
- (d) Broader Impacts: how will this project benefit the broader community/society? (5 pts)

*Proposal Main Text (10.5 pages total minimum, 13.5 maximum):*

This should consist of the following:

- (a) Background and motivation for the project, building on previous literature (4 pages minimum) (15 pts)
- (b) Description of outstanding gaps in the field (1 page minimum) (15 pts)
- (c) Statement of problem and project goals (1 page minimum) (10 pts)
- (d) Methods and approach (3 pages minimum) (10 pts)
- (e) Potential hurdles/challenges and any plans to mitigate them (1 page minimum) (5 pts)
- (f) Timeline for completion (0.5 pages minimum) (5 pts)

*References (unlimited page limit) (5 pts)*