

Master of Science in Sustainability Management

SUMA PS5140: Sustainability Science

MW 6:10pm-8:00pm

3 credits

Elective

Instructor: Jenna Lawrence, Ph.D., Lecturer in the Climate School,
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Office Hours: Before and after class, also by appointment

Response Policy: Email response within 24 hours

Facilitator/Teaching Assistant: Hansheng (Max) Jin, jin.hansheng@columbia.edu

Office Hours: By appointment

Response Policy: Email response within 24 hours

Course Overview

Achieving sustainability requires an understanding of the capacities and dynamics of ecosystems, including their long-term ability to produce resources and to assimilate waste. Students will learn not only the fundamentals of ecology and environmental science, but also how to reconcile the disconnect between human actions and ecological consequences – as well as why managers should care. We will explore the science behind current issues in biodiversity, energy, agriculture, equity, freshwater use, marine conservation, and climate change.

This is a lecture-based elective that fulfills Area 3 (Physical Dimensions of Sustainability). No previous science knowledge is required. The course is in person and full semester. Space permitting, cross-registrants from other graduate programs are welcome.

Learning Objectives

Upon successful completion of this course, students should be able to:

- L1- Recognize that biodiversity is a fundamental characteristic of our Earth system and includes all living aspects, from genes to species to ecosystems.
- L2- Identify interconnections among the living and non-living components of our world, including those that provide services benefitting human well-being as well as those affected by human activities.
- L3- Analyze complex issues using interdisciplinary perspectives, including ecological, social, and equity dimensions.
- L4- Evaluate humans' roles in both problems and solutions
- L5- Delve deeply into a chosen topic, assessing the current state of knowledge, including where gaps exist and why.
- L6- Learn how to go right to the source: critically evaluate methods of research, management, and analysis through the use of primary literature.

Readings

Required textbook:

Wright RT. Boorse DF. 2017. 13th Edition. *Environmental Science: Towards a Sustainable Future*. Pearson.

Other Required Readings (available on CourseWorks)

Adapted from: **The Course Syllabus: A Learning-Centered Approach, 2nd Edition**, Judith Grunert O'Brien, Barbara J. Millis, Margaret W. Cohen. ISBN: 978-0-470-60549-3. Available as an E-Book from Wiley at:

<https://www.wiley.com/en-us/The+Course+Syllabus%3A+A+Learning+Centered+Approach%2C+2nd+Edition-p-9780470605493>

Primary literature:

Des Roches, S., Brans, K. I., Lambert, M. R., Rivkin, L. R., Savage, A. M., Schell, C. J., ... & Alberti, M. (2021). Socio-eco-evolutionary dynamics in cities. *Evolutionary Applications*, 14(1), 248-267.

IPBES (2019) The global assessment report on Biodiversity and ecosystem services. Summary for policy makers. (pp. 9-19)

https://files.ipbes.net/ipbes-web-prod-public-files/inline/files/ipbes_global_assessment_report_summary_for_policy_makers.pdf

IPBES (2023) Summary for policymakers: Invasive alien species and their control (pp. 11-17)

<https://zenodo.org/records/10521002>

<https://www.ipbes.net/ias/learning>

Gatti, L. V., Basso, L. S., Miller, J. B., Gloor, M., Gatti Domingues, L., Cassol, H. L., ... & Neves, R. A. (2021). Amazonia as a carbon source linked to deforestation and climate change. *Nature*, 595(7867), 388-393.

Leopoldina (2021) Climate change: causes, consequences and possible actions

https://www.leopoldina.org/fileadmin/redaktion/Publikationen/Infomaterial/Factsheet_Klimawandel_1.1_EN_web.pdf

Pörtner, H. O., Scholes, R. J., Arneth, A., Barnes, D. K. A., Burrows, M. T., Diamond, S. E., ... & Val, A. L. (2023). Overcoming the coupled climate and biodiversity crises and their societal impacts. *Science*, 380(6642), eabl4881.

Schell, C. J., Dyson, K., Fuentes, T. L., Des Roches, S., Harris, N. C., Miller, D. S., ... & Lambert, M. R. (2020). The ecological and evolutionary consequences of systemic racism in urban environments. *Science*, 369(6510), eaay4497.

The Economics of Biodiversity: The Dasgupta Review. (2021). Headline Messages.

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/957629/Dasgupta_Review_-_Headline_Messages.pdf

Websites:

Amazon Tipping Point: Up to 47% Forest Threatened by Climate Change and Deforestation, Study Warns

<https://www.euronews.com/green/2024/02/14/amazon-tipping-point-up-to-47-forest-threatened-by-climate-change-and-deforestation-study->

Avoiding Plagiarism

<https://integrity.mit.edu/handbook/academic-writing/avoiding-plagiarism-paraphrasing>

Between Pigs and Anchovies: Where Humans Rank on the Food Chain

<https://www.npr.org/sections/thesalt/2013/12/08/249227181/between-pigs-and-anchovies-where-humans-rank-on-the-food-chain>

Borneo is Burning: How the World's Demand for Palm Oil is Driving Deforestation in Indonesia (CNN)

<https://edition.cnn.com/interactive/2019/11/asia/borneo-climate-bomb-intl-hnk/>

Devastating Drought in Amazon Result of Climate Crisis, Study Shows

<https://www.theguardian.com/environment/2024/jan/24/devastating-drought-in-amazon-result-of-climate-crisis-study-shows>

Ecuador Court Upholds ‘Rights of Nature,’ Blocks Intag Valley Copper Mine

<https://news.mongabay.com/2023/03/ecuador-court-upholds-rights-of-nature-blocks-intag-valley-copper-mine/>

‘Giant Methane Factories’: Hydropower Has Long Been Touted as Clean Energy. But is it?

<https://insideclimatenews.org/news/14072023/todays-climate-hydropower-methane-clean-energy/>

How Do Animals Safely Cross a Highway? Take a Look

<https://www.nytimes.com/interactive/2021/05/31/climate/wildlife-crossings-animals>

The Invisible Force Keeping Carbon in the Ground

<https://www.theatlantic.com/science/archive/2023/10/tree-survival-fungi-corsica-climate-change/675739/>

Lions Making Fewer Zebra Kills Due to 'Chain Reaction' Involving Invasive Ants

<https://www.theguardian.com/environment/2024/jan/25/how-invasive-ants-are-impeding-lions-hunt>

The Massive, Unregulated Source of Plastic Pollution You’ve Probably Never Heard of

<https://www.vox.com/recode/23056251/nurdles-plastic-pollution-ocean-microplastics>

Why Climate Change is an Environmental Justice Issue

<https://news.climate.columbia.edu/2020/09/22/climate-change-environmental-justice/>

Why this Coyote and Badger 'Friendship' has Excited Scientists

<https://www.nationalgeographic.com/animals/2020/02/coyote-badger-video-behavior-friends/>

Videos (available on CourseWorks):

After Largest Dam Removal in U.S. History, This River Is Thriving (3:21)

<https://www.youtube.com/watch?v=VipVo8zPH0U>

The Bat Man of Mexico (BBC, not required) (1 hour)

<https://vimeo.com/371311851>

Bringing Back the Colorado River Delta (5:47)

<https://www.youtube.com/watch?v=YnzWDo3VFao>

Cordyceps (BBC) (3:03)

<https://www.youtube.com/watch?v=XuKjBIBBAL8&t=6s>

The Last of Us opening scene (HBO, not required) (3:11)

https://www.youtube.com/watch?v=teuRjx7s_8k

Ant mutualism (5:15)

<https://www.youtube.com/watch?v=1h7KV2sjUWY>

Caecilian mother and babies (BBC) (3:32)

<https://www.youtube.com/watch?v=DMvL4zOLSeM>

How Wolves Change Rivers (4:34)

<http://www.filmsforaction.org/watch/how-wolves-change-rivers/>

Watershed: The Race to Save the Colorado River (10:32)

<https://www.youtube.com/watch?v=E9b5j4JnNlw&app=desktop>

Grading

The final grade will be calculated as described below:

FINAL GRADING SCALE

Grade	Percentage
A+	98–100 %
A	93–97.9 %
A-	90–92.9 %
B+	87–89.9 %
B	83–86.9 %
B-	80–82.9 %
C+	77–79.9 %
C	73–76.9 %
C-	70–72.9 %
D	60–69.9 %
F	59.9% and below

[Indicate the grade weight for each assignment and whether the grade is assigned to the individual or to the group/team.]

Assignment/Assessment	% Weight	Individual or Group/Team Grade
Exam 1	30	Individual
Exam 2	30	Individual
Term paper	40	Individual

Course Schedule/Course Calendar

Date	Topics and Activities	Readings (due on this day) (websites on CW)	Assignments (due on this date)
7/1	Introduction to sustainability science; Fundamentals:	W&B: Ch. 1, 3, 6, Ch. 22.5 (pp. 563-546); Dasgupta; IPBES (2019)	

	Biodiversity I (valuing biodiversity)		
7/3	Biodiversity II: threats	W&B: Ch. 4; IPBES (2023); Gatti <i>et al.</i>	
7/8	Fundamentals: Population ecology (interactions within species)	W&B: Ch. 4	
7/10	Fundamentals: Community ecology (interactions between species)	W&B: Ch. 4; Des Roches <i>et al.</i> ; Schell <i>et al.</i>	
7/15	Fundamentals: Ecosystem ecology; Sustainability of marine resources I: Eutrophication and invasive species	W&B: Ch. 3 (pp. 48-53, 62-70), Ch. 5; Ch. 20 (pp. 506-508, 512-515, 523-530)	Paper topic due
7/17	Exam 1		
7/22	Sustainability of marine resources II: Overfishing	W&B: Ch. 7 (pp. 171-178)	
7/24	Sustainability of agriculture	W&B: Ch. 12 (also relevant material about pesticides in Ch. 13)	Paper outline due
7/29	Freshwater issues	W&B: Ch. 10	
7/31	Energy issues	W&B: Ch. 14-16	
8/5	Climate change	W&B: Ch. 18; Pörtner <i>et al.</i> ; Leopoldina	
8/7	Exam 2		
8/11			Final paper due

Course Policies

Participation and Attendance

I expect you to come to class on time and prepared. If you miss an experience in class, you miss an important learning moment, and the class misses your contribution.

Makeup exams will be given only in cases of illness or emergency, and you must notify us before it is given.

Late work

Work that is not submitted on the due date noted in the course syllabus without advance notice and permission from the instructor will be graded down 1/3 of a grade for every day it is late (e.g., from a B+ to a B).]

Citation & Submission

All assignments should be submitted to CourseWorks (not via email). The term paper should be sufficiently cited (e.g., APA format), preferably using primary, peer-reviewed literature,

Academic Integrity

Plagiarism will result in a zero for the assignment and possible disciplinary action. If in doubt, ask. Additionally, use of text-generating software (such as ChatGPT) is not permitted and will be treated as plagiarism. (See below for additional school and university policies.)

School and University Policies and Resources

Copyright Policy

Please note—Due to copyright restrictions, online access to this material is limited to instructors and students currently registered for this course. Please be advised that by clicking the link to the electronic materials in this course, you have read and accept the following:

The copyright law of the United States (Title 17, United States Code) governs the making of photocopies or other reproductions of copyrighted materials. Under certain conditions specified in the law, libraries and archives are authorized to furnish a photocopy or other reproduction. One of these specified conditions is that the photocopy or reproduction is not to be "used for any purpose other than private study, scholarship, or research." If a user makes a request for, or later uses, a photocopy or reproduction for purposes in excess of "fair use," that user may be liable for copyright infringement.

Academic Integrity

Columbia University expects its students to act with honesty and propriety at all times and to respect the rights of others. It is fundamental University policy that academic dishonesty in any guise or personal conduct of any sort that disrupts the life of the University or denigrates or endangers members of the University community is unacceptable and will be dealt with severely. It is essential to the academic integrity and vitality of this community that individuals do their own work and properly acknowledge the circumstances, ideas, sources, and assistance upon which that work is based. Academic honesty in class assignments and exams is expected of all students at all times.

SPS holds each member of its community responsible for understanding and abiding by the SPS Academic Integrity and Community Standards posted at <https://sps.columbia.edu/students/student-support/academic-integrity-community-standards>. You are required to read these standards within the first few days of class. Ignorance of the School's policy concerning academic dishonesty shall not be a defense in any disciplinary proceedings.

Diversity Statement

It is our intent that students from all diverse backgrounds and perspectives be well-served by this course, that students' learning needs be addressed both in and out of class, and that the diversity that the students bring to this class be viewed as a resource, strength and benefit. It is our intent to present materials and activities that are respectful of diversity: gender identity, sexuality, disability, age, socioeconomic status, ethnicity, race, nationality, religion, and culture.

Accessibility

Columbia is committed to providing equal access to qualified students with documented disabilities. A student's disability status and reasonable accommodations are individually determined based upon disability documentation and related information gathered through the intake process. For more information regarding this service, please visit the University's Health Services website: <https://health.columbia.edu/content/disability-services>.

Class Recordings

All or portions of the class may be recorded at the discretion of the Instructor to support your learning. At any point, the Instructor has the right to discontinue the recording if it is deemed to be obstructive to the learning process.

If the recording is posted, it is confidential and it is prohibited to share the recording outside of the class.

SPS Academic Resources

The Division of Student Affairs provides students with academic counseling and support services such as online tutoring and career coaching: <https://sps.columbia.edu/students/student-support/student-support-resources>.

Columbia University Information Technology

Columbia University Information Technology (CUIT) provides Columbia University students, faculty and staff with central computing and communications services. Students, faculty and staff may access University-provided and discounted software downloads.

Columbia University Library

Columbia's extensive library system ranks in the top five academic libraries in the nation, with many of its services and resources available online.

The Writing Center

The Writing Center provides writing support to undergraduate and graduate students through one-on-one consultations and workshops. They provide support at every stage of your writing, from brainstorming to final drafts. If you would like writing support, please visit the following site to learn about services offered and steps for scheduling an appointment. This resource is open to Columbia graduate students at no additional charge. Visit <http://www.college.columbia.edu/core/uwp/writing-center>.

Career Design Lab

The Career Design Lab supports current students and alumni with individualized career coaching including career assessment, resume & cover letter writing, agile internship job search strategy, personal branding, interview skills, career transitions, salary negotiations, and much more. Wherever you are in your career journey, the Career Design Lab team is here to support you. Link to <https://careerdesignlab.sps.columbia.edu/>