COLUMBIA UNIVERSITY
School of Professional Studies

Master of Science in Sustainability Science

SUSC PS5250 Fundamentals of Economic and Financial Risks of Climate Change

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Office Hours: 30 mins before and after class or by appointment. Contact the instructor anyway for an appointment.
Response Policy: I will try to get back to your emails within 24-48 hours. When sending emails, note your last name followed by dash and the course number in your subject line. In case it is urgent, please add that to the subject line. If you plan on asking multiple involved questions, please schedule a meeting with me.
Teaching Assistant: TBD
Office Hours: TBD
Response Policy: TBD

Climate change is affecting every aspect of our society from the economic to financial ones, exposing investors in residential and commercial real estate, those in infrastructure and supply-chain to risks of flooding, droughts and forest fires. In this course, we will explore the relationships between climate change, economics and finance through a series of presentations, in-class exercises and guest speakers. Obviously, the links between climate, economy and finance are too big to be explored within a single course and the goal of the class is to provide students with

1) basic knowledge of climate change physical processes and updated trends
2) test cases of how some climate hazards might have been impacting the economic and financial sectors,
3) basic economic and financial tools that can help quantify the impact of current and future climate scenarios on economic and financial sectors
4) hands-on and group exercises to explore the relationships between climate change, economics and finance and perform activities that will simulate real-world assignments in professional context
5) access to world leading experts in climate economics / finance

This is a class geared towards Sustainability Science students and no economic or financial background is required. Students from the Sustainability Management program or from other programs are more than welcome to attend, though they might find themselves already familiar with some of the introductory material.

An undergraduate background in any field of science or engineering and mathematics through statistical and time-series analysis is not required but preferred. An interest in coupled natural-human systems, economics and climate change is desirable. Students should at least be familiar with standard office software to support their completion of course assignments. Programming skills at intermediate or advanced level are desirable but not required.

Students will first be exposed to basic knowledge of physical processes of climate change and updated information on trends and records (#1, 2); then, they will be exposed to examples of how climate hazards have been driving economic or financial impacts and which lessons we have learnt (#2). Then, students will explore a "Classic" of the economics, the "hedonic" modeling and how this can be applied to environmental and climate problems (#3). This will be followed by the discussion of the Stern report (#4), a post-Stern (#5) discussion followed by studying how climate change is integrated into economic estimates - Integrated Assessment Models , IAMs and a role-play to simulate future warming scenarios using a web-based tool (#5, EnRoads). On the 6th class, we will have our first guest lecturer, Jeffreey Schlegelmilch, director of the Columbia Center for Disasters Preparedness and students will be introduced to the EmDAT dataset, which will be used in class # 10 and #11 for an in-class project. Class # 7 will see another expert as a guest, Sandra Goldmark from Barnard, talking about the circular economy. We will also discuss, time

allowing, a test case on the flooding in Thailand in 2011 and the impact on the semiconductor industry and financial markets globally. Class #8 will be Spring Break. Class # 9 will see the presentation by students in class. Beside wrapping up the EMdat exercise, we will talk about Climate justice and equity transition in Class #11. in Class # 12, we will talk about greenhouse gas estimates, the carbon markets and netzero with our guest Paul Denoon and we will talk about real estate and climate transition in class # 14 with an in0-class exercise using a specifically designed tool. Last class will be dedicated to the presentation of final projects and wrap up.

By the end of this course, students will be able to attain the following learning objectives:

1. Elucidate major physical and economic components of climate change
2. Describe and quantify current and future climate impacts and the interactions among the physical and economic/financial systems within a sustainability context
3. Describe in general terms how an understanding of applied sustainability science informs risk assessment, perception and management within the framework of climate change and its economic reverberations
4. Acquire knowledge of the areas of basic physical (climate change) and economic/financial science research applicable to applied sustainability science and translate basic scientific research for application
5. Describe and implement some of the technologies necessary for environmental observation and assessing impacts on human systems
6. Effectively communicate the importance of climate change and their economic impact with regard to sustainability science for effective sustainability management

#	Overarching Theme	Sub-theme	Topics and major activities	Breakout document
1a	Introduction to Class	Introduction	a) Engage with the Introduction to the teacher's background and history of class b) discuss learning objectives and the class structure ; c) introduce themselves and will explain what drove them to the class	Storyboard Lecture 1a
1b	Physical aspects of climate change: overview	Science core	Familiarize with physical aspects of climate change	Storyboard lecture 1b
2a	Physical aspects of climate change: overview (cont'd)	Science core	a) providing answers to multiple choices quizzes or to simple questions concerning the previous class; b) Will listen and engage through lecture - Finishing basics of climate change \	Storyboard lecture 2a
2b	Examples economic and financial aspects of climate change	Connecting activity	a) Will listen and engage through lecture - Examples of economic and financial impacts; b) Four corner debate	Storyboard lecture 2b
3a	Introduction to hedonic modeling	Economic tool	Introduction to hedonic modeling and basic economic concepts	Storyboard lecture 3a
3b	TEST CASE: Hedonic modeling	In-class exercise	In-class exercise: Hedonic modeling	Storyboard lecture 3b

4a	Stern , economic impacts of climate change	Economic core	a) Discussion of previous class; b) Introduction to externalities and basic economic concepts; c) First part of Stern video	Storyboard lecture 4a
4b	Stern part 2 + short paper in class	Economic core	a) Second part of Stern video ; b) Write a 5 minutes paper and share	Storyboard lecture 4b
5a	Post stern slides + IAMs	Connecting activity	Post stern slides / Climate models , IAMs and assessments	Storyboard lecture 5a
5b	TEST CASE: ENROADS	Test case	ENROADS	Storyboard lecture 5b
6a	Jeff Schlegemiel guest lecture	Expert Talk	Guest Jeff Schl: cost of disaster	Storyboard lecture 6a
6b	Introduction to EMDAT and other datasets	Connecting activity	Datasets for disasters and economic / social impact test case	Storyboard lecture 6b
7a	GCircular economy	Expert talk	Guest lecture by Sandra Goldmark	Storyboard lecture 7a
7b	Connecting economic , financial and climate impacts	Connecting activity	Financial impact on semiconductors (https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2019WR026092, https://www.boj.or.jp/en/research/wps_rev/wps_2022/data/wp22e06.pdf, https://elibrary.worldbank.org/doi/abs/10.1596/26862)	Storyboard lecture 7b
8	No Class	N/A	SPRING BREAK	
9a	Mid-term discussion	Co-creation and collaborative growth	In-class discussion of mid terms	Storyboard lecture 9a
9b	Introduction to disasters datasets	Connecting activity	Intro to disasters datasets and in-class activity	Storyboard lecture 9b
10a	Introduction to EMDAT (cont'd) and exploring the dataset	Connecting activity	as above	Storybord lecture 10a
10b	EMDAT in-class exercise	In-class exercise	EMDAT In-class exercise with Excel visualizer	Storyboard 10b
11a	Home assignment on EMDAT discussion	Co-creation and collaborative growth	Discussion of home assignment on EMDAT project	Storyboard 11a
11b	Climate justice and economics	Science core	b) Climate justice and economics;	Storyboard lecture 11b
12a	Greenhouse gas estimates tools		a) Introduction to Greenhouse Gas tools online ; b) the carbon footprint of everything	Storyboard lecture 12a

12b	Paul de Noon: Carbon markets and NetZero	Expert talk	Guest lecture : Paul de Noon	Storyboard lecture 12b
13a	Real estate, economics and climate change		a) Real estate, climate change and sustainabililty ; b) Introduction to CRREM	Storyboard 13a
13b	The CRREM tool		In-class CRREM Exercise	Storyboard 13b
14a	CRREM tool exercise and discussion	TBD	a) Discussion of previous class;	Storyboard lecture 14a
14b	TBD	TBD	Synthesizing lessons learnt : Mind mapping exercise	Storyboard lecture 14b
15	Final projects			Storyboard 15

The above is a draft of the syllabus. The final version will be posted on Canvas before class begins.
The mid-term project will consist in a literature review or at-home research on a topic of choice. The topic could be something we have discussed in class or we will be discussing. The final project will consist of a study carried out by students on a topic selected during the course that aims at merging the knowledge acquired during the semester. Group projects are allowed after consulting with the teacher. In this case, the role of each student within each group must be clearly specified and supported by any material. Final projects might be in the form of an essay, in-depth literature review with a perspective on the topic by the student (e.g., perspective paper style), generation of maps and discussion/ implications or similar. For their final project, students will submit a final report (see below for details) together with slides for an 8-10-minute presentation on their work, depending on the number of projects and students.

Class Participation (40 %)

Class participation, including oral and written communication, is crucial for succeeding. Weekly readings and/or assignments must be completed before class and will help contextualize class discussions. Classes will start with collecting questions from the students and a follow up discussion. Come to class having read the material, having written down one or more questions, and ready to participate in classroom discussions (see Table for specific assignments). Classroom participation makes up 40 % of your final grade. Most importantly, it gives us a window on your interests and grasp of the material.

Midterm Paper (25 %) and Final Paper/Presentation (35 %)

Students will write a short midterm paper and prepare a paper and a presentation on a semester-long project. Group projects are allowed after coordination with the instructor. In this case, students will still have to write independent midterm papers on the project and will have to include how they plan to collaborate. For the midterm paper students will prepare a literature review of a topic of their choice. The topic doesn't have to be among those discussed in class but it will have to be pertinent to the course. Students are required to prepare a written description of the project results (1000 - 1500 words, plus references and, eventually, figures). An example of guidance on how to write a literature review can be found here: https://www.scribbr.com/methodology/literature-review/.

The final project will consist of an in-depth analysis of a topic among those discussed in class. Students can select among the following options: 1) essay on a problem faced in the economic or financial world related to climate change (private sector enterprise, government agency, community group); 2) perform quantitative or qualitative analysis of a case. The topic can be similar or a continuation of the literature review proposed during the mid-term. The final format will be of a Word document

(2000-2500 words plus references and figures) PLUS a formal oral presentation (~10 minutes each) delivered to the class at the end of the semester.

All papers will be graded according to the rubric method. An example can be found here: https://www.stetson.edu/other/writing-program/media/rubrictermpaper.pdf.

Course Policies

Participation and Attendance
Students are expected to come to class on time and thoroughly prepared. The instructor will keep track of attendance and look forward to an interesting and lively discussion. If you miss an experience in class, you miss an important learning moment and the class misses your contribution. More than one unjustified absence will affect your grade by 15 %. The impact of your absence on your midterm and final grades is to the discretion of the instructor. Justified absences will be granted for extreme circumstances and pending documentation, when possible and or requested by the instructor. In any case, absences should be notified to the instructor in advance, when possible.

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 (eg., from a B+ to a B).

Citation & Submission
All written assignments must cite sources and be submitted in person or to the course website (not via email).

Laptops, cell phones and other devices.
Neither laptops nor phones are allowed in class unless authorized by the instructor or for projects' purposes.

Resources

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: http://library.columbia.edu/.

SPS Academic Resources
The Office of Student Affairs provides students with academic counseling and support services such as online tutoring and career coaching: http://sps.columbia.edu/student-life-and-alumni-relations/academic-resources.

School Policies

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 http://sps.columbia.edu/student-life-and-alumni-relations/academic-integrity-and-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.

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: http://health.columbia.edu/services/ods/support